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This Month's Cover

View from the crow's nest of Humble Oil & Refining Company's barge "CAP" as a 72-foot, 18-ton prefabricated templet is lowered into the Gulf at Grand Isle eight miles off the Louisiana coast. Completed drilling platform at this location measures 110 by 260 feet. Lower deck is 32 feet above mean water level and the derrick floor is 60 feet above the water's surface. The man-made drilling island was built in water 50 feet deep, the first to be built in water more than 30 feet deep. Photo courtesy The Humble Way.

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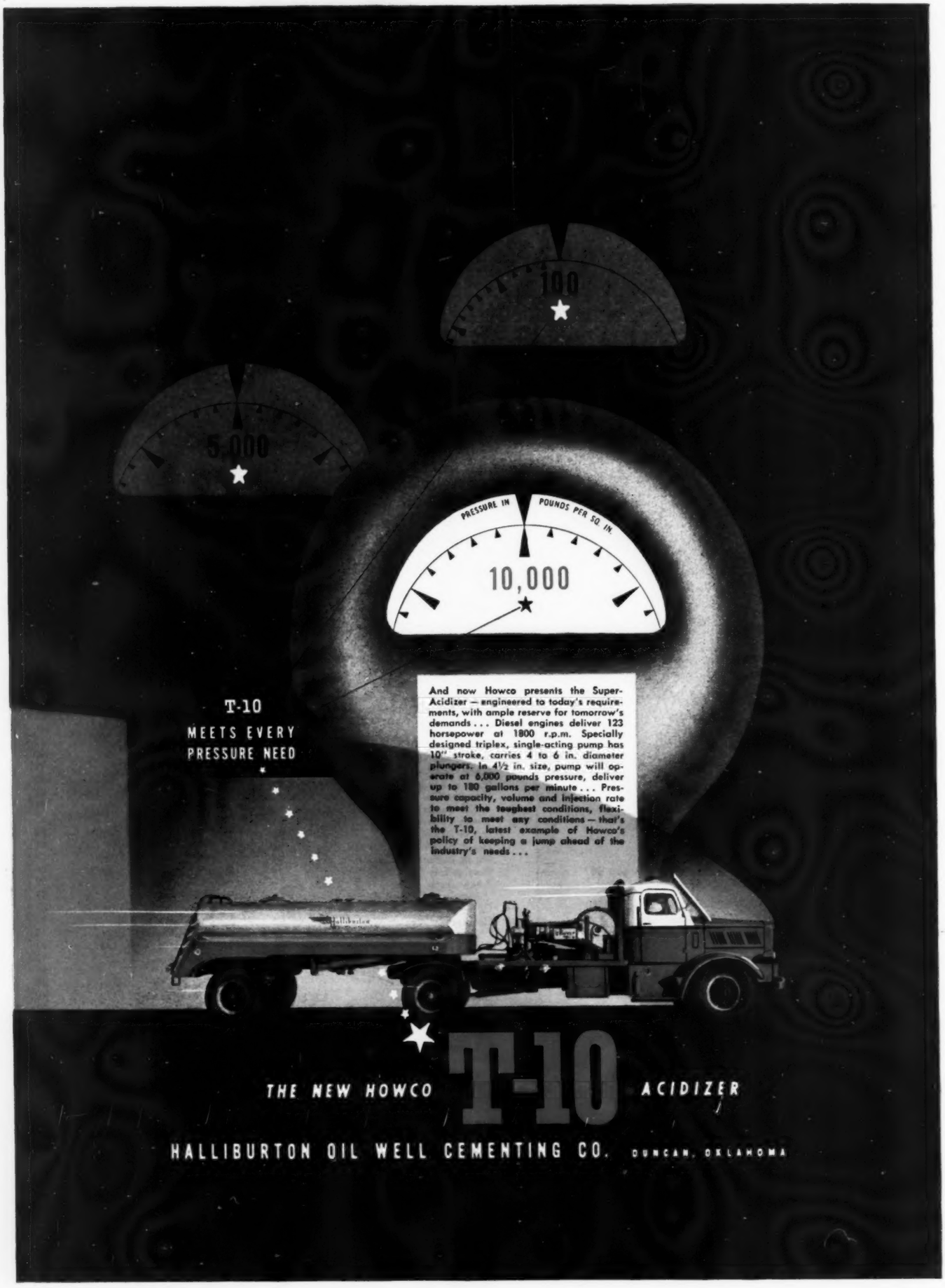
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OIL AND STEEL IN THE WORLD CRISIS

WITH the deepening of the world crisis, new factors have arisen to complicate the oil situation and particularly the situation in that part of the world in which the United States has volunteered to take the lead in providing security and halting the spread of autocracy. New elements that have been injected affect the requirements of production, of transportation and of all the operations of an industry that has become fundamental to the maintenance of industrial wellbeing in time of peace and vital to the conduct of modern war.

Out of a period of frustration and indecision, a definite policy is being shaped by the free nations of the western world. The aim of that policy is to prevent war by making themselves strong. And since huge quantities of petroleum are equally necessary whether the outcome be peace or war, it becomes important not only to provide it in increasing volume but also to assure its availability under any conditions that may arise.

In earlier forecasts of liquid fuel requirements of the United States during 1948, it was assumed that these would continue to grow but that the high rate of increase recorded during the past year would moderate to some extent. Later developments have changed these calculations and have led the Bureau of Mines to revise its estimate of needs to 6,230,000 barrels daily for all oils. This is an increase of some 450,000 barrels daily over last year, which is approximately the measure of the actual increase in processing during the early months of the year. The estimate, which may be regarded as a minimum, reflects the anticipated course of civilian consumption under unrestricted commercial movement.

With the projected expansion of air, sea and land forces, a new element is introduced that may substantially affect total demand. For a long time the military authorities have been studying the question of stockpiling to provide an immediately available supply of petroleum products for use in case of emergency. As part of the preparedness program now under consideration, these authorities include the accumulation in storage of substantial stocks of the products needed for military operations, including some products not formerly rated of first-line military importance which are now required by changes in airplane design and fuel requirements. There is evident, however, an inclination to make this accumulation gradually in ways that will not interfere with the normal functioning of the industry, perhaps by arrangements with oil companies to provide the necessary storage.

Petroleum figures largely in the project for support of economic recovery in western Europe now coming into operation. In the report prepared for the Committee for European Economic Cooperation, import requirements of crude oil and products were set at roundly 450 million barrels in 1948, increasing by another 100 million or more by 1951. An integral part of the program is the building of refineries in Europe to process imported crude and the construction of pipelines in the Middle East and elsewhere to feed these plants, requiring the use of large quantities of material, chiefly steel for construction purposes.

Long before these extraordinary demands had become more than possibilities, the oil industry itself had formulated plans for expansion of its facilities to meet the prospective growth in demand. These plans included the drilling of many more wells, the laying of thousands of miles of pipelines and the expansion of refining facilities to process the increased flow of oil. The projected expansion likewise applied to fields in other continents in which American companies are operating. Capital expenditures far greater than in any past period of the industry's history and amounting to thousands of millions of dollars yearly were authorized. The industry is prepared to do its full part in meeting the requirements both of civilian expansion and international security, provided it can be supplied with the materials necessary to the enlargement of its operations.

A report by a committee representing the oil industry of the United States declares that domestic needs of steel for the oil and gas industries, including the requirements of United States companies for foreign operations, amount to over 10 million tons for the current year. Altogether the oil industry, to meet its worldwide demands, could readily absorb 25 percent of current steel production, which is substantially more than is likely to be made available to it.

Viewing the situation from a broad angle, the problem before the oil industry and particularly the problem before those who may determine the allotment of its essential supplies is to provide the steel and other materials that will enable it to do the job that it is able and ready to do which will avoid all danger of shortages. If all requirements cannot be met, effort should be concentrated on the most necessary requirements at home and abroad. Immediate necessities are plain. They should not be sacrificed to long-range or doubtful projects.

Fig. 1. Aerial view of Asmari Mountain.

OIL PRODUCTION FROM FIELDS OF SOUTHWESTERN IRAN

By H. S. Gibson

On the occasion of his acceptance of the Redwood Medal on March 10, H. S. Gibson, general fields manager of Anglo Iranian Oil Co., Ltd., presented a lecture on the development of oil fields of Southwestern Iran. The lecture was a fascinating account of the history of the fourth largest oil field in the world from its discovery 37 years ago to the present time, the methods by which water intrusions have been prevented and the growing knowledge of the mechanisms of production from this type of formation. Because of space limitations it has been necessary to condense Mr. Gibson's lecture. Editor.

The first field discovered in Southwestern Iran was Masjid-i-Sulaiman, which began producing in 1911, and to date has produced just over 120 million tons of crude, which makes it the fourth largest single field in the world, the three larger being, of course, East Texas, the Lagunillas field in Venezuela, and the Balakhany-Sabunchy-Romany field of Baku. Masjid-i-Sulaiman is still producing about 3¾ million tons a year (or 29 million barrels) and although a total of 229 wells have been drilled, the greatest number ever used for production at one time was 31. With so many wells available for observation purposes, and the length of time it has been producing, far more is known about Masjid-i-Sulaiman than any other of the fields of Southwestern Iran, and the development of control and the study of the mechanism of production of the Iranian fields is in effect a history of this field.

The reservoir rock of the oilfields of Southwestern Iran is a marine fissured limestone named after Asmari Mountain (Fig. 1), where the limestone outcrops a few miles away from Masjid-i-Sulaiman as a typical whaleback structure. The mountain is very similar in shape and size to the Masjid-i-Sulaiman reservoir, and provides a full-scale model which can be examined at leisure.

Sir Andrew Agnew presenting the Redwood Medal of the Institute of Petroleum to H. S. Gibson, general fields manager, Anglo-Iranian Oil Co. Ltd.

The limestone is Upper Oligocene to Lower Miocene in age, and is about 1000 ft. thick. When a well drills into the rock, no appreciable production is obtained until a fissure is penetrated, no matter how richly oil-bearing the cuttings appear to be. The individual capacities of the wells range from 500 to 2000 tons per day each, which explains why more than 31 wells were not required on production at any one time. At first, drilling was confined to the area of the discovery well, which is located at about the midpoint of the southwest flank of the structure in the district known as Naftun, as shown in Fig. 2.

In 1923, a well fitted with high-pressure fittings was drilled into the gas dome, and from its pressure and the pressure in the oil zone it became possible to calculate the position of the gas-oil level, which was found to be falling about 15 ft for each million tons of crude produced.

By the same year, wells had been drilled towards the northwest in the district known as Naftak, and the area from which production was drawn was being slowly extended in that direction. In 1921 it had been shown that the closed-in-pressure of the first well drilled at Naftak was affected by the opening and closing of wells at Naftun three miles away, thus proving extreme freedom of connection through the reservoir.

From the time when production had first begun, some concern was felt at the lack of knowledge of the position of the edge water and its movement. Wells were successively located deeper and deeper down the southwest flank until in the first half of 1924 a well reached water after drilling past a good oil show. The position of the oil-water contact in the well was carefully measured and closely observed. It was quickly established that the oil-water level was not rising at the rate to be expected from the reservoir being in free connection with an external water table; in fact, for over two years there was no definite indication of any rise at all. This was, of course, a great discovery, and showed that the crude oil reserves were very considerable.

By 1927, production was being drawn along practically the whole of the southwest flank, and wells had been drilled along the greater part of the northeast flank. As there was still no sign of edge-water encroachment, the reservoir had come to be regarded as a closed tank from which crude could be drawn at any desired rate, so freely did the wells flow and so slightly did their producing rates decline. A drilling program was bringing in new producing wells at the rate of 15 to 20 a year.

In August 1927 a very serious occurrence took place. Well No. 56 at the Naftak end of the southwest flank began to produce salt water in considerable quantity, although the bottom of

the well was some 200 ft. above the estimated oil-water level. Tests soon showed that the rise of water was local, for water observation wells on either side, one two miles away, and the other a mile and a quarter, showed no change of oil-water level either up or down. Several wells in this area had only recently been connected to production, and as all the wells drilled there had proved to be good producers, an off-take comparable with that drawn from the original producing area was allocated to them. The effect of this production on the pressure in the reservoir is shown in Fig. 3. This diagram shows the free oil level as measured in non-producing wells located round the perimeter of the field. Free oil level is the height above sea level at which the oil stands in the casing of a well which is not being drawn upon for production. The column of oil in the casing is in balance with the pressure in the oil zone of the reservoir, and it is in effect a sensitive pressure-gauge. The free oil level is at once a measure of the pressure in the oil zone, and, under a common gas dome, an indication of the relative gas-oil level.

The pressure in the vicinity of Well No. 56 was nearly 40 psi. lower than in the producing area in the middle of the southwest flank, and 65 psi. lower than on the opposite flank. It was immediately realized that this pressure difference must be the cause of the water entering the well, and production from the Naftak area was at once closed down.

In order to avoid similar occurrences in the future, it was decided that the reservoir would have to be treated as a unit and a uniform pressure maintained in all sections. This was a very important step forward in reservoir control, and to put it into effect it was necessary to have a continuous record of the pressures all over the field, for which special observation wells would be necessary. It was noticed from the free oil levels shown in Fig. 3 that in some parts of the reservoir the pressures of adjacent wells were in close agreement, and that in others there was considerable difference. It was therefore concluded that the reservoir was divided more or less effectively into sectors or compartments round the perimeter inside which the connection between wells was so good that they were self balancing, and it did not matter from which well, or wells, production was drawn. The boundaries of these compartments are shown in Fig. 3 by short lines drawn across the gradient lines connecting the wells.

The next step was to balance up the field, and at the same time begin to find out what proportion of the total production could be drawn from each compartment to give a uniform-pressure drop in the oil zone throughout the reservoir. This was done by trial and error, the Naftak section being shut down for the first year. It soon became obvious that the field is far from being uniformly productive. The Bibian sector, for example, produced about 50 per cent of the total crude, although the volume of the reservoir rock there is only 20 per cent of the field. It was later found that the allocation to the Naftak sector should have been 10 per cent.

Fig. 2

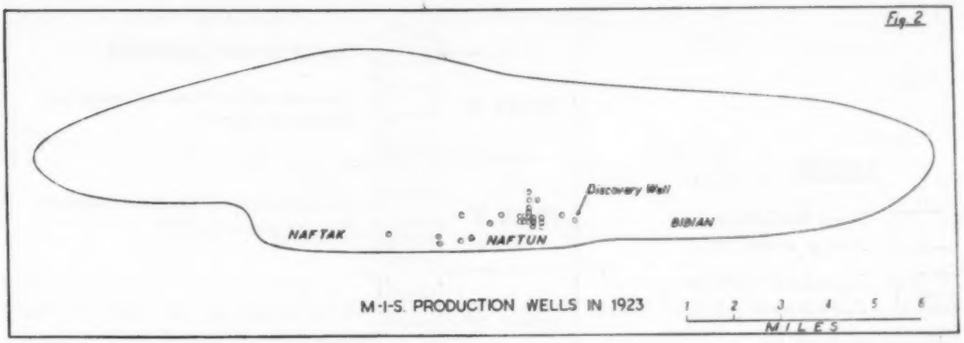
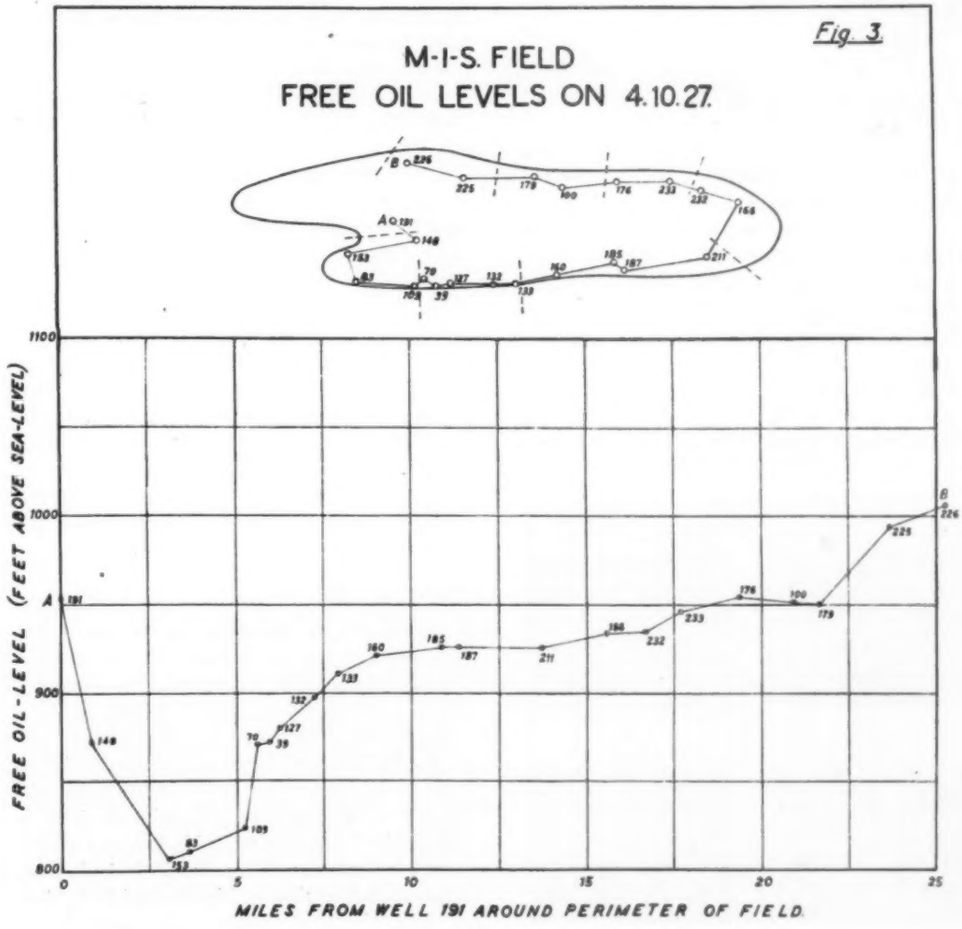


TABLE I.
Asmari Limestone Classification

Types.	Visual characteristics.	Average porosity (approx.).	Average permeability (millidarcys.).	Microscopic Characteristics.	Degree of recrystallization.
Type 1	Dark grey to light grey and fawn limestones, compact and shiny.	2%	0.00005	Very fine grained rather marly, fossils well preserved.	Practically nil.
Type 2	Light grey, fawn and light brown limestones, compact.	5%	0.0007	Fine grained, more crystalline and less marly than Type 1. Fossils well preserved.	Negligible.
Type 3	Brown and sometimes light brown limestones, rather granular with some visible voids.	10%	0.05	Rather coarse-grained crystalline limestones. Fossils often destroyed or poorly preserved.	Considerable.
Type 4	Brown and dark brown limestones; granular, with many visible voids.	15%	0.5	Coarsely grained crystalline limestones, only rare traces of fossil remains.	Almost complete.

Fig. 3



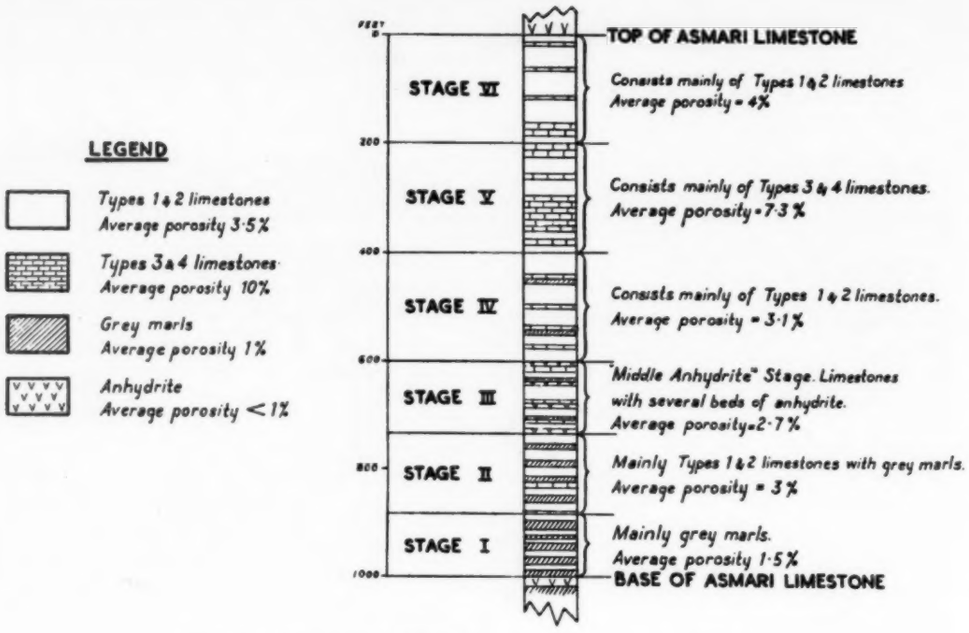


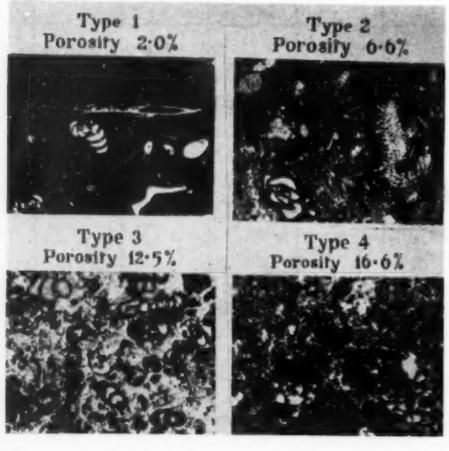
Fig. 5. Asmari limestone Masjid-I-Sulaiman log showing generalized lithology.

Well No. 56, which had produced water, continued to do so whenever tested for the next eight months, but after nine months was water-free, and within fourteen months was back on continuous production with no trace of water. The oil-water level in that sector returned to its normal position and has remained normal ever since.

The process of balancing pressure and fluid levels over the whole reservoir took just over four years to complete. During the drilling of wells, it had become increasingly obvious that production was obtained only if an open fissure was penetrated. Sometimes a well would drill only 2 or 3 ft. into the limestone before obtaining large production; at other times 300 ft. or more of limestone would be drilled without any sign of production, and then suddenly the well would be a producer.

Although it was felt that all the oil produced came from fissures, the possibility of production coming from porous limestone was never entirely ruled out, so in 1930 an extensive investigation of the reservoir rock was undertaken. The conclusions reached by this investigation were that while the limestone was to some extent porous and permeable, production was not dependent on porous or cavernous limestone, but upon open fractures, and that production depending on the permeability of porous limestone under reservoir conditions was so low as to be entirely negligible.

Fig. 4. Microphotographs of the four types of limestone found in the field.



About a year later, however, an incident occurred which threw considerable doubt on the above conclusion, and re-opened the whole question of the possibility of production from porous limestone. In the sector on the northeast flank adjacent to Asiab well, No. 245, apparently a normal well, capable of producing about 1000 tons per day was started on steady production at only about one-third of this quantity. In spite of this low off-take, within eleven days the gas-oil level in its vicinity had fallen an average of 85 ft. instead of a maximum anticipated fall of 2 ft. The well was immediately closed, and within a month the gas-oil level was completely restored.

The well was then brought on to production very slowly, and it was found that an off-take of 150 tons per day kept the pressure of that zone in equilibrium with the remainder of the reservoir. At this rate the fall of gas-oil level was approximately one-fifth of a foot per day, instead of 8 ft. per day for the initial production rate of 330 tons. This difference could only mean that although the well was supplied with oil from a fissure, the fissure was replenished from a source from which the rate of flow was limited. It now began to look as though this effect might be due to some of the oil coming from porous limestone, in spite of the fact that all the samples of rock examined had appeared so compact and had had such a low permeability that it did not appear possible.

(At this point in his paper Mr. Gibson related in detail the extensive investigation which was undertaken to determine the relative importance of fissures and pores as a source of oil in the fields.—Editor)

A very interesting fact which emerged from the artificial-fissure experiments was that about one half of the total pressure drop in a well occurs within 18 inches of the hole, and that more than 95 per cent occurs within 50 ft. of the well. This means that unless a well has penetrated a fissure which behaves more or less as an extension of the hole, the bottom-hole differential is very unlikely to be able to cone up edge water unless the water is within say 50 ft., and also that the pressure reduction at the foot of a well is applied to only a very small volume of limestone in the immediate vicinity.

With the growing evidence that porous limestone apparently plays a very large part in the production of crude, a re-examination of the reservoir rock was undertaken. In an investigation of the distribution of porosity it was noticed that a close relationship existed between the color and the porosity of various limestone samples, and it thus became possible to make an approximate estimate of the distribution of porosity by visual examination of samples, which greatly facilitated what would otherwise have been a very laborious task.

By visual examination it was found possible to classify all samples of limestone into four types, the details of which are in Table I.

There is a definite relationship between the porosity and permeability of the limestone, for an almost straight line is obtained when the one is plotted against the other on semi-log paper. The permeabilities in Table I are taken from this graph at the porosities given. It will be noted that the porosity seems to depend upon the degree of recrystallization, but even when completely recrystallized the port spaces are so fine that they bear no resemblance to even the finest-grained sandstone.

Micro-photographs of the four types are given in Fig. 4.

The next step was to examine samples from wells which had drilled completely through the reservoir rock and assess the porosity distribution on the basis of the four types of limestone. The result is given in Fig. 5, in which, for the sake of clarity, the two lower porosity types and the two higher are grouped together. The overall picture shows the upper 400 ft. of the reservoir to contain considerably more pore space than the lower 600 ft. The lower 600 ft. is composed of thin, marly limestones interbedded with grey marls, the proportion of the latter increasing with depth. The upper 400 ft. is much more thickly bedded, being almost massive in

character. The beds of limestone and marls constituting the Asmari Limestone are not continuous, but appear to be more or less lenticular in form, the only bed which appears to be continuous throughout the reservoir being the middle Anhydrite which tends to isolate the lower 400 ft. from the upper 600 ft.

(Mr. Gibson reported on laboratory experiments which proved that oil was produced from the porous limestone by a dissolved gas drive.)

The remarkable thing about these results is that they are practically idential with the results obtained with oil sands of very much higher permeability. From this experiment with limestone, it appeared that the very much lower permeability had negligible effect also, though one would have expected that with lower permeability and a consequent higher surface-volume ratio in the pores, a large amount of oil would have been retained on the walls of the pores as an unrecoverable film.

Beginning in 1931, when a successful bottom-hole sample taker had been designed, the saturation pressure of the crude had been measured in many wells. From these measurements it has been deduced that the saturation pressure in various parts of the reservoir before production began may have approximated to the values shown in Fig. 6.

These values would apply only to the fissure system, and higher pressures undoubtedly existed in porous limestone remote from the fissure.

As far as is known, the Masjid-i-Sulaiman reservoir was full of oil when discovered, with no free gas in the crest of the structure. Seepages in the region of the crest were very active, and it is assumed that the liquid lost through seepage was made up by the rise of edge water, with the result that there was a slow loss of pressure throughout the reservoir.

A fairly clear picture of conditions in the Masjid-i-Sulaiman reservoir having now been built up, it was possible to visualize the mechanism by which oil was obtained from it.

When production first began, the crude was initially drawn from the fissures, which in turn drained the fissures in the crestal region, so forming a gas dome in which the pressure was lower than the crude-oil saturation pressure in the porous limestone there. As a result of this lower pressure in the gas-filled fissures, oil would begin slowly to ooze from the rock above gas-oil level.

As the oil came out of the limestone it was accompanied by bubbles of gas which had been in solution in it, but as soon as they entered the fissure these bubbles migrated upwards to the gas dome. At a rough estimate 15 per cent of the gas originally in solution in the oil remains in the reservoir and helps to maintain the dome pressure.

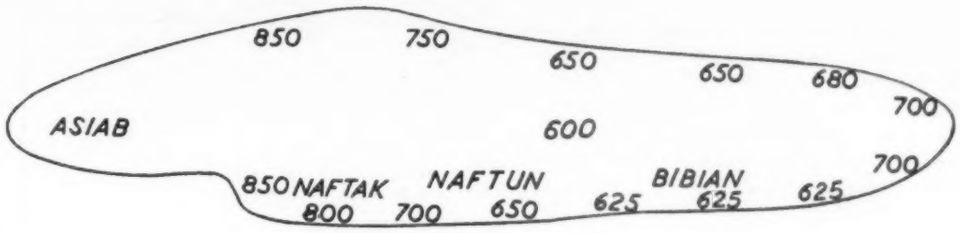


Fig. 6. Estimated saturation pressures psi. before production began.

By the time the re-examination of the reservoir rock had been completed and the experiment on the recovery of oil from porous limestone had been carried out, it had become apparent that far from being of negligible value in the production of crude, porous limestone was responsible for the greater part of the production obtained.

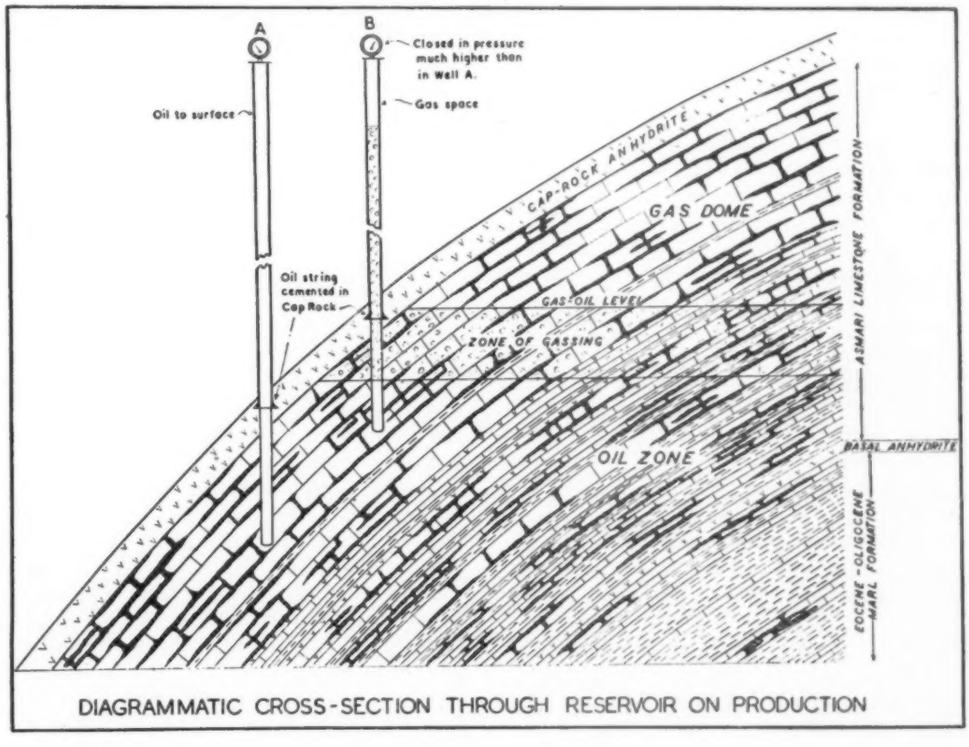
Surveying the whole of the evidence now available we can see that there is no firm dividing line between fissures and pore space. On high rates of production some of the finer fissures will behave as pores, while on low rates of production it is quite probable that the most permeable limestone will behave as fissures. It is possible to visualize a rate of production such that only a very limited quantity of oil has time to come from pore space, and from our experience of well No. 245 this rate is not as high as might be imagined. The point at which the open fissures begin to carry a disproportionate amount of the production load is quite sharply defined, and if it is exceeded it becomes almost impossible to control the reservoir.

It has already been stated that there must have been a flow of water into the reservoir to make up for the volume of oil lost by seepage, and the most likely place for it to come from would have been via the exposure at Asmari Mountain.

A fact which must not be overlooked, however, is that a reservoir such as Masjid-i-Sulaiman contains an enormous volume of fluid in porous limestone below oil-water level, and that the reduction of pressure due to production, amounting to an average of about 16 psi. per annum, is effective on this fluid. Although the compressibility of fluids is very small, when very large volumes are concerned the effect can be quite appreciable. It is now accepted that the rise of edge water in several oil fields is due entirely to the decompression of water. It is probably safe to say that the slowly rising edge water at Masjid-i-Sulaiman is due to a combination of a very restricted connection to an external source and to the expansion of the fluids in the limestone below oil-water level with reduction of pressure. The word fluids is used in this case instead of water, because in several wells which have drilled into the limestone below oil-water level, rock samples have been found to contain considerable quantities of oil in addition to water. The expansion of both oil and water over the range of pressures concerned is a straight-line effect.

Although it has now become quite clear that porous limestone is responsible for the greater part of the production and that the quantity obtained from fissure space amounts probably to

Fig. 7



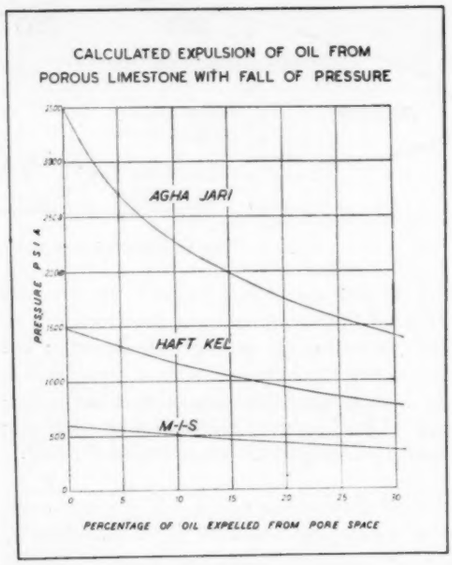
something of the order of 10 percent only, the importance of the fissures must not be minimized, because without them production would be impossible. The Bibian sector of Masjid-i-Sulaiman is far more fissured than any other part of the field, and its productivity is greater than any other, that is, within the time and at the rate that oil has been produced from the field. The oil in the limestone at Bibian has a shorter distance to travel to a fissure, and therefore it comes out more quickly. Although the rate of increased off-take from the whole field has been limited since 1937 to 20 percent in one month it was found better to draw most of this in the first place from Bibian and then slowly transfer the correct proportion to the northeast flank as the field steadied down to the new conditions.

Consideration of the rate of pressure change permissible in a field brings up the question of the optimum and maximum rates of production. It would appear that a Haft Kel producing at 2.22 million tons a year was more efficient than producing at 4.1 million tons, because if production had continued at the lower rate it seems fairly certain than an additional 6.5 millions tons of oil could have been obtained from the same pressure drop that gave a total of 16.5 million tons at the higher rate. Part of this 6.5 million tons would belong to porous limestone left behind by the more rapidly falling gas-oil level at the higher rate of production, and would undoubtedly be produced in course of time; it could therefore be regarded as deferred production. The remainder, being production from oil-water level, would be more likely to be lost, because if an appreciable part of the water rise was due to decompression, the rise would be more rapid and there would be less time available for this additional amount of water to displace crude in porous limestone, and so some crude might be lost.

The maximum rate of reduction of pressure that a field will stand is dependent entirely on the degree of connection to an external source of water supply and to the total amount of fluid below oil-water level subject to the reduction of pressure, both items being considered in relation to the nature of the fissure system, which, if small, is not in contact with sufficient oil-filled porous limestone to accommodate the rising water within a reasonable time.

Assuming that oil left behind above gas-oil level is deferred production and will eventually be obtained, the optimum and maximum rates of production for a field depend upon the rate of rise of edge water. If the rate of rise of edge water is fairly slow and uniform (such as the rate of 1 ft. per month at Masjid-i-Sulaiman) and there are no sudden erratic movements then the rate will not be far removed from the optimum. If, on the contrary, edge-water movements are erratic but are subject to a general rapid rate of rise, it can be assumed that it would not be safe to increase the off-take beyond that amount.

For two reservoirs having approximately the same amount of recoverable reserves and the same edge-water conditions, but the one having a deep oil column and covering a smaller area, and the other having a shorter oil column and covering a larger area, the latter would be able to produce at the higher rate, because for a given production the reduction in height of oil column would be less, with a correspondingly smaller rise of reduction of pressure on the edge water.


CALCULATED EXPULSION OF OIL FROM
POROUS LIMESTONE WITH FALL OF PRESSURE
AGHA JARI
HAFT KEL
M-I-S
PRESSURE P S I A
PERCENTAGE OF OIL EXPELLED FROM PORE SPACE
Fig. 8

Provided the rate of production in such that the oil-water level rises at a reasonable rate the only other limitation is the permeability of the limestone. Experience at Masjid-i-Sulaiman suggested some years ago, but without any real evidence to support it, that the off-take from the field should not exceed 5 per cent per annum of the remaining recoverable crude in the reservoir. This seems to have worked very well, but the great difficulty in applying it is the estimation of the remaining reserves. The slower the rate of production the greater seem the reserves and vice versa.

To adhere precisely to such a rule is not economic, because it involves building up to a peak rate and then almost immediately beginning to reduce. In actual practice the field would be brought up to 3 or 4 per cent of its estimated ultimate yield and then maintained at this steady rate for ten years or so until the rate is equal to 5 per cent of the remaining recoverable crude.

In describing conditions in the Masjid-i-Sulaiman field in 1927 it was stated that the value of gas conservation was fully appreciated and that the pressure in the gas dome was falling less than 2 psi. per annum; it was later explained that the dome pressure was maintained with gas which had been expelled, together with oil, from porous limestone. For this oil and gas to come out of the porous limestone it was essential that the pressure in the fissure system should be lower than the saturation pressure of the oil in the rock, and yet the gas which collected in the dome and maintained the pressure there was also maintaining a similar pressure throughout the fissure system. The maintenance of the dome pressure is therefore preventing oil and gas from coming out of the porous limestone into the fissures. Instead of being allowed to collect in the dome and thus hinder the production of oil the gas should be produced with the oil to which it belongs. The gas-oil ratio of the crude coming from porous limestone is approximately 45 to 1, and the average gas-oil ratio of the crude arriving at the surface at the present time is about 35 to 1. The other 10 volumes are collecting in the gas dome. It is not physically possible to produce the whole of the gas which belongs to the crude with the crude, but that is not necessary, for all that has to be done is to produce sufficient gas from the dome to bring the overall producing gas-oil ratio up to 45 to 1. It is estimated that during the producing life of Masjid-i-Sulaiman about 15 per cent of the gas originally in solution in the crude produced from porous limestone has been collected in the gas dome.

Within the last thirty years considerable progress has been made in the improvement of the recovery of oil from sand reservoirs. Three different mechanisms are now generally recognized:

(1) Water drive;
(2) Gas cap drive;
(3) Dissolved gas drive.

They are here given in the order of their efficiency. Both water drive and gas cap drive require a sand of high uniform permeability to reach their greatest efficiency, and even then the rate of production must be restricted to something like 3 or 4 per cent of the estimated ultimate recovery, otherwise by-passing and channelling take place with consequent non-recovery of oil.

It is clear that neither of these mechanisms would be very efficient in the limestone reservoirs of Southwestern Iran with their enormous range of permeability, the range being from the infinite permeability of the fissures to that of the lowest porosity limestone. Although experiment has shown that some 10 to 15 per cent of oil in place can be recovered by displacement with water, the fortuitous nature of the fissuring would almost certainly prevent even this small recovery being effective over all the limestone submerged by rising edge water.

It is also clear from the effect of gas accumulation in the gas dome described above, that the injection of gas to apply gas-cap drive to these limestone fields would not only be of no assistance, but would definitely reduce the amount of oil obtained, because it would put a back pressure on to the limestone surfaces of the fissure system.

It will be recognized that the production mechanism of Masjid-i-Sulaiman is mainly dissolved-gas drive, with gravitational drainage from the fissure at gas-oil level and water drive in the fissures and porous limestone at oil-water level as subsidiaries.

What will happen in the future in the fields of Southwestern Iran it is impossible to say, as none of the reservoirs there has as yet approached the end of its producing life, and we have therefore nothing to guide us.

(Continued on page 128)

Site of the refinery at Whitehorse, Yukon, before dismantling operations.

WORLD'S MOST TRAVELED REFINERY

ON the banks of the Saskatchewan River adjoining Edmonton, capital city of Alberta, an oil refinery is being rushed to completion by Imperial Oil Limited. It is perhaps the most traveled refinery on earth.

Such an introduction requires explanation. Oil refineries represent structures of massive steel, tanks of vast dimensions, hundred-foot towers and intricate equipment, all of which total thousands of tons in weight. Once such major construction is completed, the finished job generally remains where it is. Edmonton's refinery however, has proved to be an outstanding exception to this rule.

Around it there will always remain an atmosphere of drama, though its career started quietly enough at Corpus Christi on the Texas Gulf Coast. Inability to obtain an adequate crude supply hampered it from the beginning. It stood idle when the Japanese threat against Alaska led the War Department of the United States to take hurried action to develop an oil supply for that territory independent of water carriage exposed to submarine attack. The plans adopted by the military authorities combined four features: building the Alaska highway; stepping up production from the Norman Wells oil field in the Canadian Northwest; building of a pipeline to a point on the Highway; erection of a refinery at the terminal of the pipeline at Whitehorse.

Because it was available, the Texas plant was selected to meet the refining requirement. It was dismantled, and shipments in parts were rushed through to Skagway on the Alaskan coast to finish the journey from that port to Whitehorse via the narrow gauge railway which follows part of the famous Trail of '98. The light rails of the little railway had to be replaced by heavier steel before such tonnage could pass over it. Additional parts for the refinery came from Hamilton, Ontario, and Pinedale, California, with equipment also being procured from 2,000 suppliers throughout the United States.

The reassembly of the refinery started in Whitehorse. Time was the essence of the agreement and the work was rushed. By the time it was completed and oil from Norman Wells was flowing through the pipeline, the Japanese menace had faded. The project undertaken to meet a war emergency was not suited to economical operation in peacetime. After V-J day the extra wells drilled at Norman Wells closed down, the pipeline lay idle and the refinery finished its brief career at Whitehorse.

Two years later, in February, 1947, the famous Leduc oil field close to Edmonton, Alberta, came into being. It soon proved to be of major importance, and Imperial Oil, Ltd., which had led the development at Leduc, decided that the establishment of a refinery at Edmonton was necessary to handle its output. To avoid the long delay

inevitable in the delivery of new equipment, the company turned to the idle refinery at Whitehorse, which was held as U. S. war surplus, and purchased it for $1,000,000.

Once again the refinery had to be dismantled, moved and reassembled. Having traveled over 4,000 miles from Texas, it was fated to travel another 1,350 miles to Edmonton. Hurriedly purchased twice, hurriedly dismantled, moved and reassembled twice, it was to be the most traveled oil refinery on earth.

The reason for hurry in the first instance was defense of the Northwest by supplying as quickly as possible one of the most needed weapons of war which is oil. The reason in the second instance was that by 1947 an oil shortage had presented itself over the face of the globe, that imports to Canada might have to be reduced and that Canada's consumption of the product as a result of this might have to be drastically lowered if home production were not speedily increased.

The moving job was a formidable one. Plant equipment was estimated to weigh about 7,000 tons. The winter season was in many ways most suitable of the task, but there were times when icy roads following a thaw halted transportation, or when mild spells removed the solidity needed to support heavy tonnage.

The story of this great venture is well told in the February-March issue of the Imperial Oil Review under the title of "The Trail of '48." It is just half a century since the wealth of Yukon's gold lured adventurers from every country in the world into its remote domain. The principal route was via Skagway and the Chilkoot Pass, but many attempted it from Edmonton, Alberta, via Whitehorse along much of the route now covered by the Alaska Highway. There was no gravelled road to help the traveler then. Transport was carried out by dog train, pack horse, wagon or on foot. The ruggedness of forests, mountains and streams put up great barriers, and many a party which had started out hopefully perished on the way.

Once more the route is historically active, but now the journey is south instead of north. The road is there to follow, great bridges cross the streams, material carried weighs from 40 to 60 tons per load, and the world's most powerful diesel trucks and trailers are there to do the job. In '98 if one got through at all, the journey represented weeks or months of heart-breaking effort. Now the allotted time for the trip is 50 hours.

The purchase price of the refinery at Whitehorse was the least part of its ultimate cost. Before it is ready for operation in Edmonton, the investment will have risen to $7,000,000, approximately the cost if new equipment had been purchased. Much valuable time will have been saved, however, by using the old and assembling it once again.

A contract for moving the plant was let to the W. M. Barnes Company, of Los Angles, an engineering and contracting firm with trained men and necessary equipment ready to start the work at once. Offices were opened in Edmonton and Whitehorse, and eight big diesel trucks and trailers were driven up from California. Sixteen drivers accompanied them and more arrived later when two more of the great trucks appeared in Whitehorse.

By the time operations were well under way, there were around 300 men on the payroll. Half this number were in Edmonton preparing the 380-acre refinery site for the arrival of equipment to be assembled. A hundred more were in Whitehorse dismantling the refinery, and the remainder were assigned to the important job of transporting the parts south.

An undertaking of such magnitude takes much organization. The removal of parts from Whitehorse coincided with the laying of the foundation for Edmonton's refinery. Everything worked on carefully planned schedule so that the objective of speedy completion might be reached.

After delivery of the trucks few of the California drivers remained for the hauling. The places of the others were taken by Canadians, many with wartime experience of the highway, a hardy group who spent most of the winter in their trucks.

These vehicles were the largest ever to have traveled this famous road. As already stated they weighed around 20 tons when empty and were equal to anything in the world for size and capacity. The biggest models boasted 21 forward speeds with a dashboard as intricate to the ordinary motorist as the instrument panel of an airplane.

Most of the equipment was moved by truck for a thousand miles over the frozen Alaska highway.

Some of the equipment was shipped to Skagway by rail, then by ship to Vancouver and rail to Edmonton.

The Alaska Highway contains many sharp curves and mountain grades. To traverse such a roadway in a truck of this weight and caliber, carrying a load of from 40 to 60 tons, takes skill and daring. It is estimated that when the moving is completed, the ten monster trucks will have covered 500,000 miles of hard and dangerous driving.

Two drivers are assigned to each truck. Only one stop for refueling in the 919 mile stretch from Whitehorse to Dawson Creek was arranged for each trip. This was at Muncho Lake, about halfway. Behind the cab of each vehicle was a box-shaped sleeping compartment. While one man slept, or tried to, the other drove. The main idea was to keep her rolling. Prior to the arrival of snow, delays to travel schedule were caused mainly by tire punctures. With 20 wheels or more subjected to the hazard of nails or sharp gravel, this was unavoidable. Snowfall removed this trouble.

It must be remembered that the Alaska Highway, though an excellent road and created through extremely difficult country in record time, was nevertheless a wartime operation. For ordinary purposes it is serviceable, but its adaptability for transport of some of the larger units of the refinery was questioned. Twenty of the heaviest loads, as a matter of fact, could not be moved until later in the winter when the roadbed was solidly frozen.

One problem was the crossing of an arm of Teslin Lake, 115 miles south of Whitehorse. It was spanned by a 3,000-foot wooden bridge, but this was not considered strong enough to support the heaviest equipment that was to be moved. An ice bridge was therefore decided upon. This involved a lot of work. Snow had to be cleared from shore to shore at the crossing close to the bridge. Holes were then cut in the ice and water was pumped over the temporary roadway which was banked with snow. Inch by inch the ice was to be thickened until considered strong enough to hold this tonnage. Before completion of the job, however, a long spell of mild weather set in and the ice bridge had to be abandoned. The principal reason for this concern was a 76-ton tank which was awaiting transport. The problem was solved by cutting the tank in two, leaving the question of its being joined together again to the welders in Edmonton.

Long hours of darkness presented one of many problems at Whitehorse. North of the sixtieth parallel there is little daylight in winter, and children have to leave their schools for home at 3:30 to avoid returning in the dark. Visibility is important for riggers scrambling up high towers and over girders far above the ground. For that reason work could only be carried on during the brief periods of daylight.

To cut up the steel framework of the power plant, 90 feet in height, was a big job. Girders were cut into lengths and each piece was numbered as a guide to the welders in reassembling in Edmonton. A caterpillar crane with 120-foot beam swung great loads without apparent effort.

The lowering of many towers to a hoizontal position on the ground called for particular attention. The largest, 146 feet in height, required two "gin poles" to assist in the job. The gin poles of heavy steel were fabricated at Whitehorse and measured 96 feet in length. They were erected vertically on each side of the tower which was then lowered on supporting cables between the poles by hauling the base of the tower away at a right angle, speed of movement at the base being controlled by a winch. The tower was laid in one piece on the ground and cut in sections for shipment.

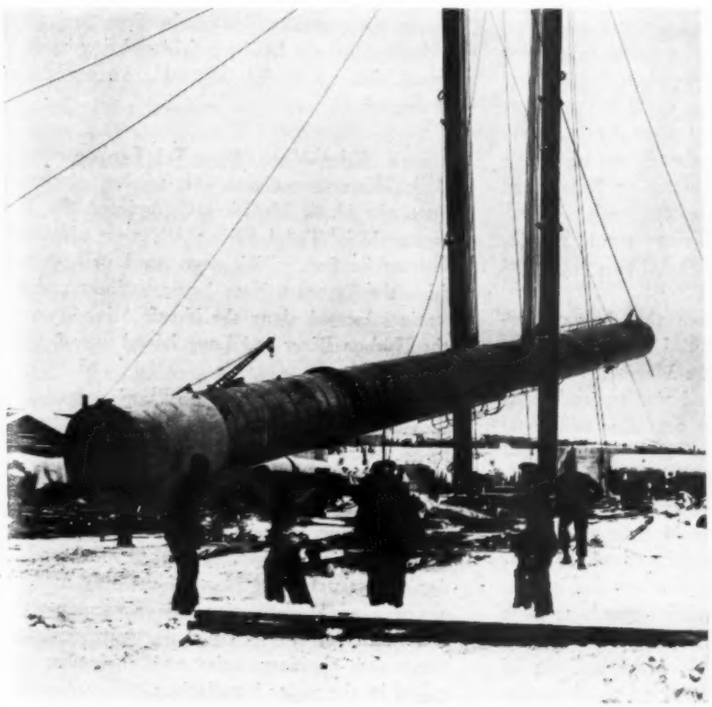
Photography played an important part in the work. Pictures were taken to give assistance in the reassembly of parts in Edmonton. Whole exteriors were photographed, and each section of the transite walling (cement and asbestos) was carefully labeled in pen and ink on the photographs. These were turned over to painters who made corresponding marks on the different parts. At a later period the Edmonton workers, with the marked photographs to guide them, were enabled to find without much trouble the correct places for each transite section.

With similar care each piece of steel was marked. In cutting the steel there were half-inch gaps where the torch had been applied. When the time came for reassembling, the pieces were laid out on forms coinciding wtih specifications of the original structure. The gaps were then filled in with steel plates until a complete unit was reassembled. A crane then raised the unit, hoisting it to an upright position on concrete foundation. Welding was then applied after the erection of the steel into the new structure.

Reassembling the mass of pipes, tubing and other complicated refinery machinery represented an involved undertaking. Thousands of blueprints produced by draftsmen during the winter, and still on the job, gave the technical information required.

Most of the great moving job is now over. The last load should be leaving Whitehorse for Ed-

Lowering a fractionating column for shipment to Edmonton.



Dismantling lines from fractionating columns.

monton shortly to finish this strenuous and definitely hazardous transport operation of the winter months.

As the season advanced, it was decided that certain parts of the sheet steel and pipes, due to shape and extreme weight, would be better shipped to Skagway by rail, then by ocean freight aboard a Canadian Pacific steamship to Vancouver and finally by rail to Edmonton. They were handled in three different consignments. The first has now arrived in Edmonton, the second has reached Vancouver and the third is on the dock at Skagway waiting to be loaded on the ship.

A year and a half in time has been saved by bringing the Whitehorse refinery to Edmonton rather than awaiting the arrival of new equipment to be purchased. For the second time in its existence the Edmonton refinery has stepped into a crisis and brought solution to a serious problem.

The new refinery will have a capacity of from 4,000 to 6,000 barrels per day. The pipeline from the field to railhead at Nisku, now in operation, will be extended 18 miles north to the refinery later in the year.

The Leduc field is at present producing around 5,000 barrels per day. By the end of the year it is hoped that this will be increased to 15,000. If so, a third of the output can be taken care of in the Edmonton refinery and the balance will go to other plants in western Canada.

H. H. Hewetson, president of Imperial Oil Ltd., when visiting Edmonton in February stated that the start of refining there was expected to take place by July with final completion of the reassembly work by the end of the current year. He mentioned that consideration was also being given to the possibility of pipeline construction from the Leduc field to Moose Jaw and Regina, to start in the next two or three years. The line would extend about 500 miles and would connect with other Alberta fields. Shortage of steel, so obvious at present, might or might not be still serious then. Oil production in sufficient quantity to warrant such expenditure was also a point to be determined.

At about the time the Whitehorse refinery was closed down following the end of hostilities, the question of maintenance of the Alaska Highway was under consideration. There were many who thought that the cost of such maintenance would not be justified at the present time. The final decision was that it should be maintained by Canadian army engineers. Had it been abandoned, the movement of the refinery over the Trail of '48 would not have been possible.

It is presumed that Edmonton's oil refinery will now remain permanently on its present site and that its travels are over. Its coming will mean a great deal to the capital city, to Alberta and to Canada. The romantic history of its travels has given it color which will always be a part of it as long as it continues in existence.

ITALY PLANS OIL INDUSTRY DEVELOPMENT

REALIZATION that the industrial development of Italy from this time on must be built upon oil rather than to continue dependent upon coal as in the prewar period has aroused a great amount of interest in the search for larger deposits of indigenous oil and in the rebuilding of the Italian refining industry on a more extensive scale. Another influence working in the same direction as far as refining is concerned is the belief that Italy is an advantageous location for the refining of oil produced either in the Middle East or in the Caribbean and as a distributing point for the Mediterranean area and western Europe.

Whatever the cause, the fact is that many projects have been put forward within the past year looking to the rebuilding and enlargement of prewar plants and the erection of new ones. In view of the financial problems involved, some strictly Italian companies have entered into agreements with strong international corporations to undertake refining or even the distribution of products for the latter and thereby have gained access to needed capital. Examples have been the undertaking between AGIP and Anglo-Iranian Oil Company which was reported some months ago and which is said to include a doubling of AGIP's Porto Marghera plant from 500,000 to 1,000,000 tons annual capacity. Another reported agreement between Standard Oil Co. (N. J.) and ANIC reputedly will lead to a rise in the combined yearly throughput of ANIC's refineries at Leghorn and Bari from 600,000 to 2,000,000 tons. Discussions believed to have been underway some months ago between California-Texas Oil Company, subsidiary of Arabian-American, and local interests connected with the Fiat Group were rumored to contemplate the erection of a new plant in northern Italy capable of processing 1,000,000 tons per year. Socony-Vacuum Oil Company and the Royal Dutch-Shell Group already are proceeding with restoration of their plants at Naples and Spezia of 300,000 tons capacity each. These, together with Aquila at Trieste would provide a combined capacity of 6,000,000 tons yearly.

This is substantially above the domestic requirements of Italy as outlined in the study prepared in connection with the Marshall Plan, but it by no means includes all the proposals that have been put forward for providing additional refining capacity. Many of these contemplated the erection of small plants, and in view of the number of applications an interministerial Committee was appointed to consider the whole subject. As a result of several meetings the committee has reviewed the applications and has indicated the oil policy which it regards as most desirable from the viewpoint of the national interest. The conclusion favors the building of large plants and specifically those of companies which from their own resources or through arrangements with international organizations, are assured of a continuity of crude supply from a variety of sources. Other advantages of large units are held to be lower operating costs, production of a wider range of products and better facilities for the utilization of byproducts in the manufacture of chemicals.

This attitude does not exclude the construction of some smaller plants, particularly where these may be needed to process domestic crude. Nor does it limit refinery expansion to the companies mentioned above. It is quite possible that other proposals will be approved, bringing the country's yearly capacity up to 8,000,000 metric tons if the prospect of finding outlets for a certain volume of exports to convenient markets appears to be soundly based.

Meanwhile the search for indigenous supplies of oil is being pushed in the valley of the Po and elsewhere. AGIP has announced a program of exploration to extend over the next three years at an estimated cost of six and a half milliard lire. The company has applied for exploratory concessions on over two million hectares in addition to the areas previously assigned to it.

Its plans include the development of 3,700 Kms of seismic profiles, the drilling of 22 wells in fields already located and 89 exploratory tests aggregating 150,000 meters.

Areas embraced within the program of exploration include a large portion of northern Italy, the Padano Venetian plain, the Marchigiana coast, the central valley of the Po. Active development of the Lodi gas field to bring its daily production up to 800,000 cubic meters is also projected.

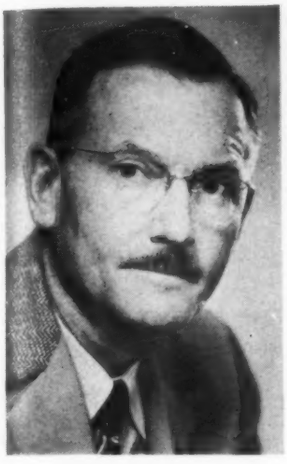
Tide Water Buys T-1 Tanker

Tide Water Associated Oil Co. has purchased from the U. S. Maritime Commission the T-1 tanker MS "Tydol Flying A" as an additional unit to its fleet. This new vessel will operate from the Bayonne, New Jersey, refinery to bulk stations located along the North Atlantic coast, the Hudson River and Long Island Sound.

To Expand Sun Plant

Expansion of Sun Oil Company's Toledo refinery over the next two years at a cost in the neighborhood of $16,000,000 was announced by Clarence H. Thayer, vice president in charge of manufacturing. The proposed expansion includes construction of an approximate 30,000 barrel-a-day catalytic cracking plant of the most modern design, a crude distillation unit, a vacuum unit, a large gas recovery plant, a new polymerization plant and auxiliary units and equipment required by the major installations.

Kent K. Kimball, consulting geologist, Tulsa, is executive secretary of the committee which has assembled the scientific display.



Dr. B. B. Weatherby, vice president of Amerada Petroleum Corp., who headed the committee in charge of the Hall of Science.

HALL OF SCIENCE PORTRAYS INDUSTRY'S PROGRESS

OCCUPYING a place of special importance and interest in the International Petroleum Exposition is the Hall of Science. The purpose of the displays and the activities centering here is to depict the historical progress of the oil industry and to interpret all phases of its operations from exploratory surveys to retail marketing through exhibits, demonstrations of equipment, motion pictures and other visual means.

Selection of the means and methods for dramatizing the technical advancement of the industry, particularly within the past few years, has been in charge of a Scientific and Technical Committee, of which Dr. B. B. Weatherby, distinguished geologist and vice president of Amerada Petroleum Company, is chairman, with Kent K. Kimball, consulting geologist of Tulsa, as executive secretary and Dr. Gustav Egloff of Universal Oil Products Company as special consultant. Special committees deal with the varied fields of activity encompassed by oil industry operations. These include Geological, Geophysical, Development and Engineering, Refining, Transportation and Marketing Committees. Each committee is manned by a dozen or more of the leading men in the special field with which his group is concerned. In addition to these specialists Dr. Weatherby and Mr. Kimball are members of each committee.

Exhibits in the Hall of Science include instruments, control apparatus and other equipment selected from among the products and design of hundreds of manufacturers. Many of these are scale models of apparatus that tell an easily understood story of a technical development or process. Those who are represented by these exhibits receive a small uniform plaque to identify the source of the exhibit. Personnel, trained by the companies they represent and at company expense, serve as hosts to visitors and delegates and explain processes, answer questions and point out interesting facts to the guests.

Aside from these specialized exhibits, visitors to the Hall of Science see a number of dramatic displays illustrating the finding of petroleum and successive steps in its processing and distribution. First of these is one explaining the formation of oil, its source, its production as concerns the exploratory work first required to discover it. Then the geological and geophysical exploration methods are explained. Next come models and exhibits that concern bringing oil to the surface with such displays at rotary rigs, augmentation devices to increase production, processes recently perfected that aid in secondary recovery.

In the geophysical section an animated film prepared by Seismograph Service Company illustrates the drilling of shot holes, detonating a charge, transmission of the acoustical waves and their reception to form a seismic record. A large display shows a geological cross section in which the travel of the waves is illustrated by the flashing of a series of tiny electric lights. Another display prepared by Geophysical Research Corporation depicts the high sensitivity of the seismic recording apparatus to minute vibrations such as those resulting from the dropping of grains of sand.

Marine survey operations are depicted by models exhibited by the United Geophysical Company, and Robert H. Ray Company displays one of its diving bells used in gravimetric offshore work. Gulf Research and Development Company shows a complete airborne magnetometer for aerial surveying of prospective oil territory.

Other displays are devoted to the uses of oil and the part it plays in the lives of the people. Scores of products having oil as a component and the conversion of oil into apparently unrelated products are correlated in this section of the hall. Methods of extraction, pilot plants, refining processes perfected since World War II and myriad exhibits of the oil age are shown.

This combination of ultra-scientific and popularized science has been designed to serve both the scientist and the layman. Through the continuity and visual presentation, the latter is able to gain a new concept of the industry, while the specialist can learn what information is available in his own line and where to go to get it.

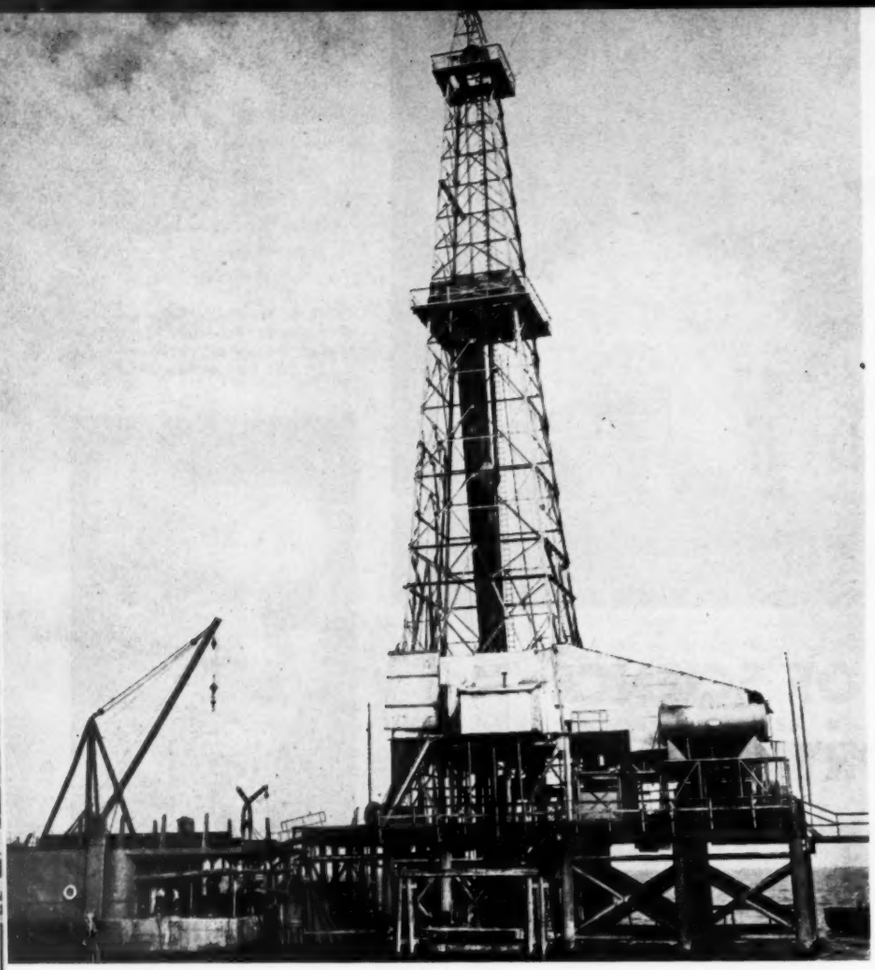
More than 50 of the best oil industry films are scheduled for presentation in the Hall of Science movie theatre. Among these are: "A New Frontier," courtesy of the Arabian-American Oil Co.; "Oil for Tomorrow," produced by Inter-State Oil Compact Commission; "Evolution," a geological picture filmed by the American Museum of Natural History; and "Oil from the Earth," made by the British Information Service, London. These are only a few of the sound films that portray the story of petroleum in all its phases. Films also supply information on the war and postwar progress of processes and equipment for exploration, drilling, production, transportation, refining and marketing of oil.

In conjunction with the Exposition and closely related to it in purpose is the International Petroleum Congress which is to hold its sessions in

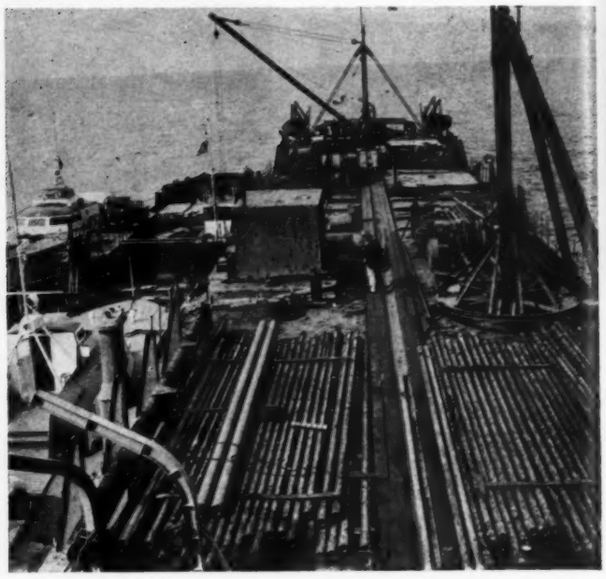
(Continued on page 129)

SPECIAL MARINE RIG BRINGS IN PRODUCER

By Arthur B. Davenport



Drilling barge used on Kerr-McGee's Block 28 well in the Gulf of Mexico was prevented from crashing into drilling platform by three dolphins each having 19 wooden pilings.



Converted U.S. Navy YF barge used as drilling barge. View taken from drilling platform shows arrangement of pipe stacks and crane.

PIONEERING work in use of a platform-barge combination for oilwell drilling in the open, unprotected waters of the Gulf of Mexico is being done by Kerr-McGee Oil Industries, Inc. One new oil field has been opened by this type of drilling and prospects seem good for a second producer.

Company's first marine drilling was off Point au Fer, Terrebonne Parish, Louisiana, and followed an extensive seismic survey of the area. Kerr-McGee was high bidder for two 20,000-acre lease blocks at the state lease sale in August, 1946, and immediately began plans for testing the structures.

Large platforms built on wooden or steel piling sunk into the ocean bed at great expense had been used for previous drilling in open waters. In addition to high cost, another objection to the huge platforms was the difficulty and expense of dismantling and removing in case of a dry hole. In the bays, bayous and swamps drilling barges had been used.

Kerr-McGee sought a less expensive set-up yet one that would be safe, portable and that would permit low-cost dismantling and removal in case of abandonment. A compromise between the all-rigid and all floating structures seemed most logical. The platform-barge combination consists of two elements: (1) a small platform on which the engine substructures, draw works, auxiliary mud pumps and derrick are mounted, and (2) a converted Navy YF barge serving as floating warehouse, house boat, crew quarters and drilling barge.

War surplus marine equipment purchased for initial operations included two Navy YF barges (260′ x 48′ x 28′); one Navy LCT (6) (120′ x 32′ beam); three 85-foot Air-Sea rescue boats for crewboats.

One of the Navy YF barges was converted into a drilling barge, the other being used by the construction contractors as a pile driving barge. This converted barge contains all essentials for drilling, including crew quarters. In the lower or hull section are reserve and operating mud pits, drilling water storage sufficient for 30 men for 60 days, and three electric power plants. On the second deck are galley and sleeping accommodations for 30 men, large food storage area with deep freeze and electric refrigeration units, dry storage for 12 boxcars of mud, chemicals, cement, diesel-powered mud pumps, work and machine shop, recreation room for the crew, and a skid-mounted Halliburton cementing unit. On top of the barge are pipe racks with 320-ton capacity, stiff-legged cranes at each end of the barge, electrical logging unit, exhaust fan, life boats, flood lights, and other boat accessories.

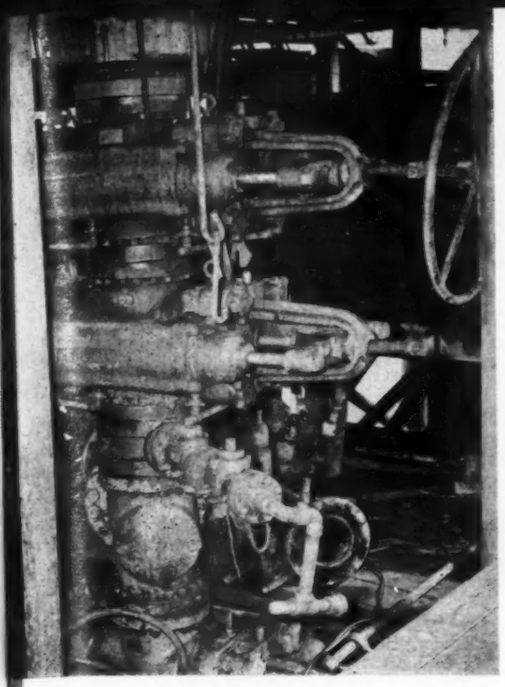
Platform for the Block 32 well, which was the first one completed, is 38 by 71 feet, supported by 16 steel piles 24 inches in diameter, 140 feet in length, penetrating an average of 104 feet into the ocean floor. Platform deck is 20 feet above mean water level. Derrick and engine substructures are 13 feet in height, one of the engine sections containing a 17-barrel capacity mud tank. Derrick was 129 feet in height, 24-foot square base, designed to withstand wind velocity of 125 miles an hour without guy wires.

Kerr-McGee's experience in Oklahoma City townlot drilling was utilized to good advantage in arrangement of equipment on the drilling platform, which is a three-deck affair.

Serving as a buffer between the floating barge and stationary platform are three creosoted timber pile dolphins, each consisting of 19 piles. Three steel H-beams, driven at 30 degree angle, are welded to a semi-circular steel plate which is then attached to the dolphins by means of wire line wrapping.

The rigid platform-floating barge combination has proved to be very satisfactory. During drilling of the first well it was necessary for the crew to abandon the drillsite on one occasion because of hurricane warning when wind velocity reached almost 100 miles an hour. No damage was done by the wind. During the construction period, all equipment was moved to protected waters on four occasions because of storm warnings. However, the lost time because of weather conditions has been relatively small, and officials believe that in the future even that record can be reduced.

Some difficulty was encountered in welding the



Five blowout preventers were used to insure against hazards. Shown are three Cameron QRC's (6,000-pound test, 3,000-pound working pressure).

steel casing, used for piling, due to the fact it was grade N-80 casing. A special welding technique was developed to overcome the difficulty.

Some operational problems were expected in such untried operations as transferring drill pipe from the barge to the derrick floor, running casing from pipe racks to the barge, cementing from the barge and running electric log from the barge. All of these tasks were performed, however, with only minor adjustments in anticipated procedure.

Biggest operational problem has been in mooring the auxiliary barge and holding it on location with respect to the stationary platform. Experience and experimentation have brought great improvements in methods. It is not expected, however, that it ever will be possible to hold the barge in position 100 per cent of the time. With continued improvements in technique, better trained personnel, and confidence resulting from actual operation, continued reduction in downtime caused by the barge being out of position is anticipated.

Another difficulty has been in evolving a method of producing the well and transporting the oil to shore where it can be handled by usual oil transportation methods. Erection of tanks at or near the drilling platform was considered too hazardous. Oil will be metered at the location and gauged in tanks on shore.

Initial tests of the discovery well were being made by flowing the oil into a 3,000 barrel oil barge anchored alongside the platform, but such practice did not meet with approval of the U. S. Coast Guard and was discontinued. To date it has not been possible to locate an oil cargo barge or other vessel of size, draft and capacity to meet the rigid Coast Guard requirements for operations in Gulf waters. Present barges with certificates for operating outside are for sea-going or coastwise service, are of very large capacity, and have draft of 18 to 20 feet when loaded. Since water depth at the drillsite is 18 feet and much less in waters between the location and mouth of the Atchafalya River, such barges cannot be used.

Solution seems to be to lay a submarine pipe line from the well to an inland barge terminal on a deep water channel, probably the Atchafalya River, where tanks would be erected and the oil measured and stored. However, operators desire to make further tests of the well's productivity before spending the $500,000 which would be necessary to lay such a line.

The discovery well was granted a special six months allowable of 400 barrels per day average flow with maximum daily rate of 600 barrels, during which time reservoir data will be obtained upon which to base the well's allowable. However, owing to the strict Coast Guard regulations the well still is shut in.

Discovery well on Block 32 is some 12 miles out in the open Gulf and 45 miles south-southeast of Morgan City. It was started September 9, 1947, and completed November 14, 1947, flowing approximately 40 barrels hourly of 25.3 API gravity oil through ½-inch positive choke through perforations at 1734-50 feet. Oil bearing sands were found at 1510-26 feet, 1535-90 feet, 1656-1721 feet, and 1731-87 feet. Salt was encountered at 2538 feet and drilled to 2568 feet. The well is on top of a piercement type salt dome. Location was made on top of the dome to prove the seismograph structure, and actually oil production at this location was unexpected.

Because of the good oil showings found in other sands in the discovery well, Kerr-McGee plans to attempt the drilling of directional holes from the platform used for the first well. Whipstocks will be set so that the bottom of each hole will be 660 feet fom the No. 1 well. Since at least three possible oil horizons were found in No. 1 well on this Block, operators believe they may be able to complete 15 producers from the single platform.

Second block to be tested is the Block 28, which is a deep-seated salt dome. Same barge that was used for the Block 32 well is being used on Block 28, and drilling platform is identical except that it is slightly larger (46' x 80'). A specially constructed rig is being used on the Block 28 well, designed to withstand even higher wind velocity.

Tom Seale, engineer in Charge, and Dean A. McGee, executive vice president of Kerr-McGee Oil Industries, Inc.

Supply depot and operating headquarters at Berwich, La., across the Atchafalya River from Morgan City, is 52 miles from the marine operations. Material and supplies are moved to the wells on LCTs, which are ideally suited for such use. Converted air-sea resue boats are used to transport personnel and small supply items. The company maintains a fleet of three 85-foot air-sea rescue boats, one 63-foot air-sea rescue boat, (six others acquired and en route to the operation,) two LCT's, one YF (yard freighter) drilling barge now in use, another in the shipyard being converted and a third being towed from the East Coast. The company also has purchased an 85-foot steel tug boat, 730 horsepower, delivery of which is expected shortly.

Present ownership of the blocks 32 and 28 is: Kerr-McGee Oil Industries, Inc., 12½ percent Stanolind Oil & Gas Company, 37½ percent; and Phillips Petroleum Company, 50 percent. Kerr-McGee has charge of operations.

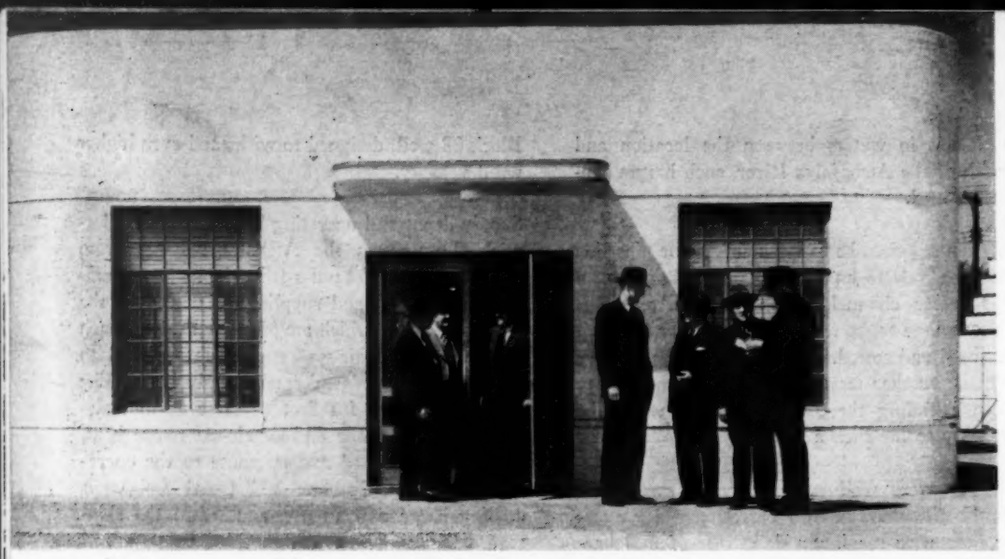
One of the biggest obstacles to marine drilling is dismantling and removal of structure in case of abandonment and utilization of such facilities in other operations. Kerr-McGee officials believe they have solved that problem by use of the barge-platform combination. One of the regulations of the War Department, from which construction permit must be obtained, is that in case of abandonment all of the structure must be removed to a depth of at least six feet below the ocean floor. When huge platforms are constructed, conformance with this regulation has sometimes been excessively expensive. Also with the rigid platform of size sufficient to support all drilling operations, the waste in case of removal has been great.

Portability of the drilling barge, which can be easily moved from one location to another, moored beside the small drilling platform during drilling operations and then towed to new location when the well is completed, has proved economically advantageous and scientifically sound from an operational standpoint.

Communications problem was solved by establishment of a complete frequency modulation network with the base station at Berwick and portable receiving and transmitting sets on all boats, the platforms, and the auxiliary drilling barge at the location. Also the drilling barge and one of the 85-foot crew boats are equipped with radio telephone for ship-to-ship and ship-to-shore communication by way of marine operators at either New Orleans or Galveston.

Kerr-McGee personnel in charge of the marine drilling operations are: Tom Seale, engineer in charge; W. F. Baxter, drilling superintendent; C. M. Howard and Dave Blanchard, tool pushers; George B. Parks, petroleum engineer; Bill Glenn, chief clerk and office manager; V. L. Janeway, communications superintendent; and Jack Phinney, marine superintendent. Dean A. McGee, executive vice president of the firm, is in direct charge of all operations.

NOMADS HOSTS TO VISITORS FROM ABROAD



International House for foreign visitors to the Exposition.

A. V. Simonson, Regent New York chapter Nomads and chairman of the Exposition committee.

APPROPRIATELY enough the Nomads, those itinerant representatives of the oil industry who roam the world maintaining good will and good business relations with oil men in all parts of the globe, are taking a leading part in the International Petroleum Exposition. Their special function is to welcome, aid and entertain the hundreds of visitors from other lands. The management of the Exposition has provided a special building—an International House—where Nomads from each of the several chapters act as hosts to guests from abroad, providing them with information, arranging for them to see exhibits in which they are interested and to make trips to fields or plants which they may care to visit—in general to make them feel perfectly at home.

John H. Baird, co-chairman of the New York IPE committee. ↓

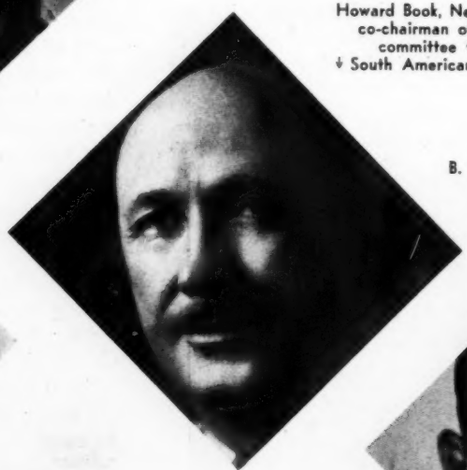
Being on the ground the Tulsa Nomads are handling many of the details of providing for the comfort and assistance of delegates, government officials and oil company personnel from abroad. Their members serve as chairmen of the various Nomad committees on which each of the four other chapters in Dallas, Houston, Los Angeles and New York have representation. These chapters have their own committees and a general chairman to coordinate their activities, and all Nomads attending the show are expected to lend a hand toward making the occasion a pleasant and memorable one for those who come to visit it from other parts of the world.

The building which has been erected for the special use of visitors from abroad and of which the Nomads have charge, is an attractive, modern structure, pleasantly furnished, well lighted and ventilated and conveniently located near the main northwest entrance to the grounds. It has the Nomads insignia inscribed above its entrance and is the point to which visitors from other countries are directed on arrival. Here they are made welcome, invited to register, can meet their friends and make appointments and can obtain information or guidance that will enable them to make the best use of their time. Interpreters are on hand to aid those who do not speak English.

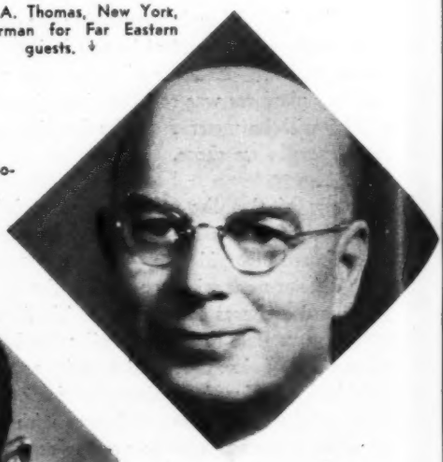
Since this is international headquarters, the duties of the committee in charge are of special importance. H. M. Cooley of the Tulsa chapter heads the Nomads International House Committee. Other members are Stewart D. Beckley, of New York, T. G. Martin, of Los Angeles, C. B. McDonald, of Houston, Brad Mills, of Dallas and Harold Cooper, of Tulsa. The genial Bart Myers of International Petroleum Company, Toronto, who acted as official welcomer to foreign visitors at the last Tulsa show in 1940, is Honorary Chairman. J. A. (Jim) Clark of Standard Oil Company (N. J.), who from many years of travel knows as many men abroad as any oil man living, represents the Exposition and the Nomads in extending greetings to visitors.

A. V. (Si) Simonson is general chairman for the

Howard Book, New York, co-chairman of IPE committee for South American guests. ↓

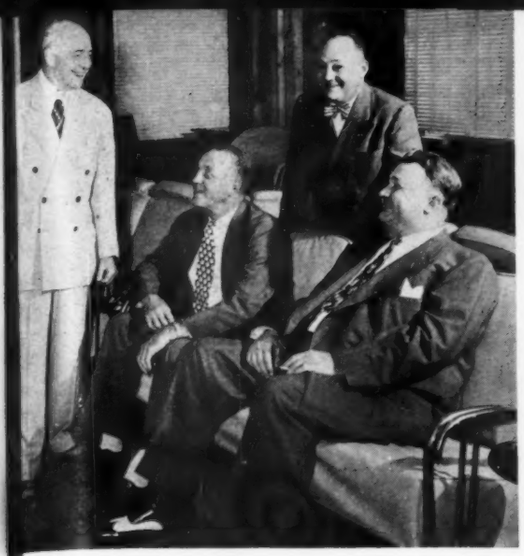


James A. Thomas, New York, co-chairman for Far Eastern guests. ↓

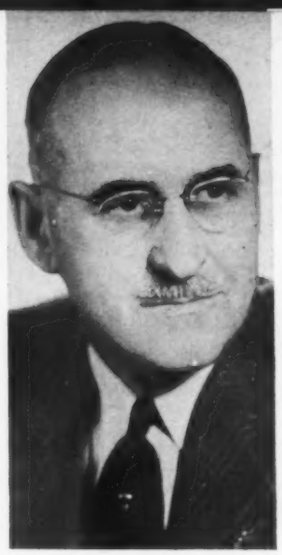


B. A. Hilliard, New York, co-chairman for Near Eastern guests. ↓

← Marvin D. Rasher, New York, co-chairman of IPE committee for Middle East guests.



Lounge in the Nomads' International House. Standing left to right: Wm. B. Way, general manager of the exposition; Ted Sutter, Los Angeles, past president of the Nomads national board of regents; seated, Henry A. Bourne and Shep Miers, regents of the Tulsa Nomads chapter.



M. D. Gilbert, president, Tulsa chapter of Nomads.

J. A. Clark, Standard Oil Co. (N.J.) chairman of the committee representing all Nomads chapters to welcome foreign visitors.

Henry A. Bourne, Tulsa, chairman Nomads national board of regents.

New York chapter of the Nomads at the Exposition. Val R. Wittich, Jr., president of the chapter, and Henry J. McAdams, vice president, are committeemen at large. M. D. Gilbert, president of the Tulsa chapter, is ex-officio member of all committees.

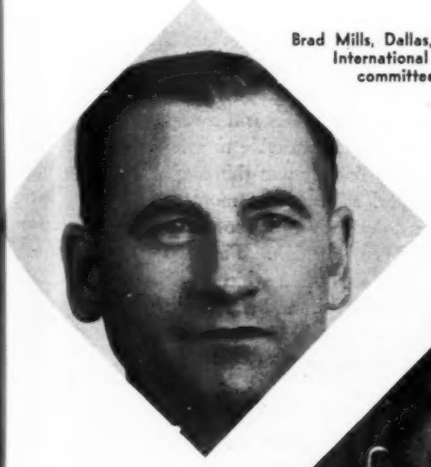
Special committees deal with finance, maintenance of the headquarters, publicity, housing and entertainment. Other committees have been appointed to look after the assistance and entertainment of visitors from each of the principal oil-producing areas outside the United States, such as Europe, South America, the Middle East, Far East and so forth. One of the principal functions arranged by the general entertainment committee, of which Henry A. Bourne, of Tulsa, is chairman, is a reception and cocktail party at the Tulsa Club on Thursday, May 20. A reception exclusively for "foreign nationals" is being held on Wednesday evening. May 19, at the Tulsa Club.

The number of visitors from abroad in attendance at the Exposition far exceeds all previous records. Advance acceptance of invitations indicated that more than 250 official delegates representing the governments or oil industry organizations of 33 countries would be present. These official delegations vary in size from a single member from some of the smaller countries to 30 or more from nations in which oil production is a principal industry. Some of the official groups are headed by cabinet ministers or other highly placed government officeholders. Gen. Joao C. Barreto, president of the National Petroleum Council of Brazil, heads the delegates from that country and is accompanied by several members of the Council. Gen. Ramon A. Albarino, president of Yacimientos Petroleos Fiscales, with heads of the various technical divisions of the company, represents Argentina. Senator Antonio J. Bermudez, general manager of Petroleos Mexicanos, heads the representatives of Mexico along with a half dozen or more prominent engineers from that company. Carlos Vegh-Garzon, president of the South American Petroleum Institute, is one of Uruguay's representatives. Ihsan Ruhi Berent repersents Turkey, the latest addition to the ranks of oil-producing countries. Many other notables are attending in official or unofficial capacities in addition to the hundreds of other visitors who have come on their individual responsibility or on behalf of their companies to see the show and to acquire information as to the progress of the oil industry.

Stewart D. Beckley, New York, member of International House committee. ↓

H. M. Cooley, Tulsa, chairman International House committee. ↓

Brad Mills, Dallas, member of International House committee. ↓

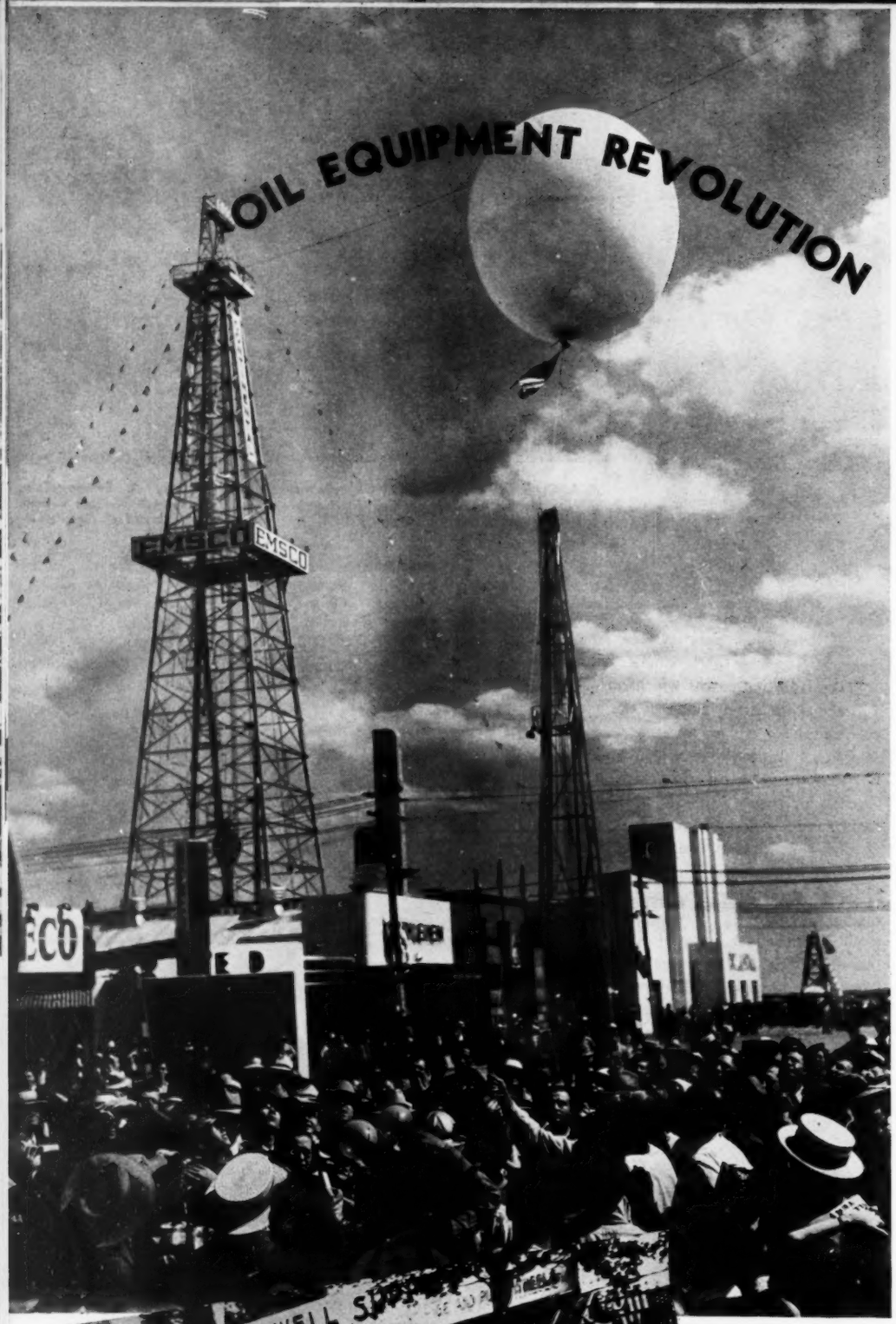


Harold E. Cooper, Tulsa, member of International House committee. ↓

C. B. McDonald, Houston, member of International House committee. ↓

T. G. Martin, Los Angeles, member of International House committee. ↑

OIL EQUIPMENT REVOLUTION REVEALED AT INTERNATIONAL EXPOSITION



At the left is a recently discovered photograph of Oil Well Supply Company's exhibit at America's first oil show at Oil City, Pa., in 1898, a quarter of a century before the first International exposition at Tulsa.

COMPARED with the most recent International Petroleum Exposition held in Tulsa in 1940, the current show reveals a genuine revolution in drilling and producing equipment. Although nearly everything is bigger or taller, it is also more mobile and may be operated with less physical labor. The industry is being put on wheels, and the push-button age has arrived.

Shortly after the first International Petroleum Exposition at Tulsa 25 years ago, it was decided that the show should be held every two years on the theory that equipment improvements exhibited at biennial intervals would have a far greater impact on the oil man. Since eight years have elapsed since the last previous exposition, it should be expected that very great changes would be evident, and in this respect the visitor is not disappointed. It is true, of course, that equipment development was largely frozen during the war) but the impression given by the silver anniversary show is that time lost during the war has been largely made up in the intensive activity of equipment designers and manufacturers since V-J Day. The legwork necessary to absorb even a small fraction of the 1948 show is something to contemplate with apprehension.

At the time of the last previous show the deepest well drilled for oil had reached a total depth of 15,004 feet and the deepest producer was 13,266 feet deep. There was still a vast reserve of productive capacity available to meet consuming demand, and nobody was thinking of invading the continental shelf to get more oil. The tallest standard derrick on the show grounds eight years ago was 136 feet high. This year 136-foot portable masts are shown which are capable of drilling to 15,000 feet, and standard rigs in excess of 190 feet are shown for handling tools capable of drilling 20,000 feet.

In the field of drilling equipment the trend toward bigness is most apparent. Almost every item from blowout preventer to crown block is bigger and stronger to stand up under the greater loads being imposed on it. At the same time the

Alf G. Heggem, chairman of the International Petroleum Congress.

William G. Skelly, president of the International Petroleum Exposition who has been a leader in the enterprise since its inception 25 years ago.

William B. Way, general manager of the International Petroleum Exposition, has helped the show outgrow its quarters several times.

Frank J. Hinderliter, vice president of the exposition.

rig is being unitized into small, compact elements so that it may be more readily moved from location to location. The trend toward easing the work of the driller and his crew by the use of more and more powered, automatic equipment is an outstanding feature of the show.

Progress in the direction of automatic mechanical drilling is seen in power tongs for both sucker rods and pipe, as well as the power slips which, although a postwar development, are now familiar to everyone. The end is not yet at hand. One large company now is experimenting with mechanical racking of drillpipe. It is reported that the rig can be run with one man on the floor and one on top. On this experimental rig slips are set, joints are made and broken, pipe racked and returned to the well, all as a mechanical operation controlled by the driller.

The commercially offered controls being exhibited at the Exposition are only a little less spectacular than mechanical drill pipe racking. Brakes have been developed to the point where 700,000 pounds of drill pipe can be lowered under perfect control at speeds so slow as to be barely perceptible. One such is the Dynamatic brake which operates on the principle of eddy currents which are created when the shaft connected to the drawworks turns inside an electrical field. Suggestion has been made, since the Dynamatic was announced, that the converse of this brake be used to deliver power to the drawworks.

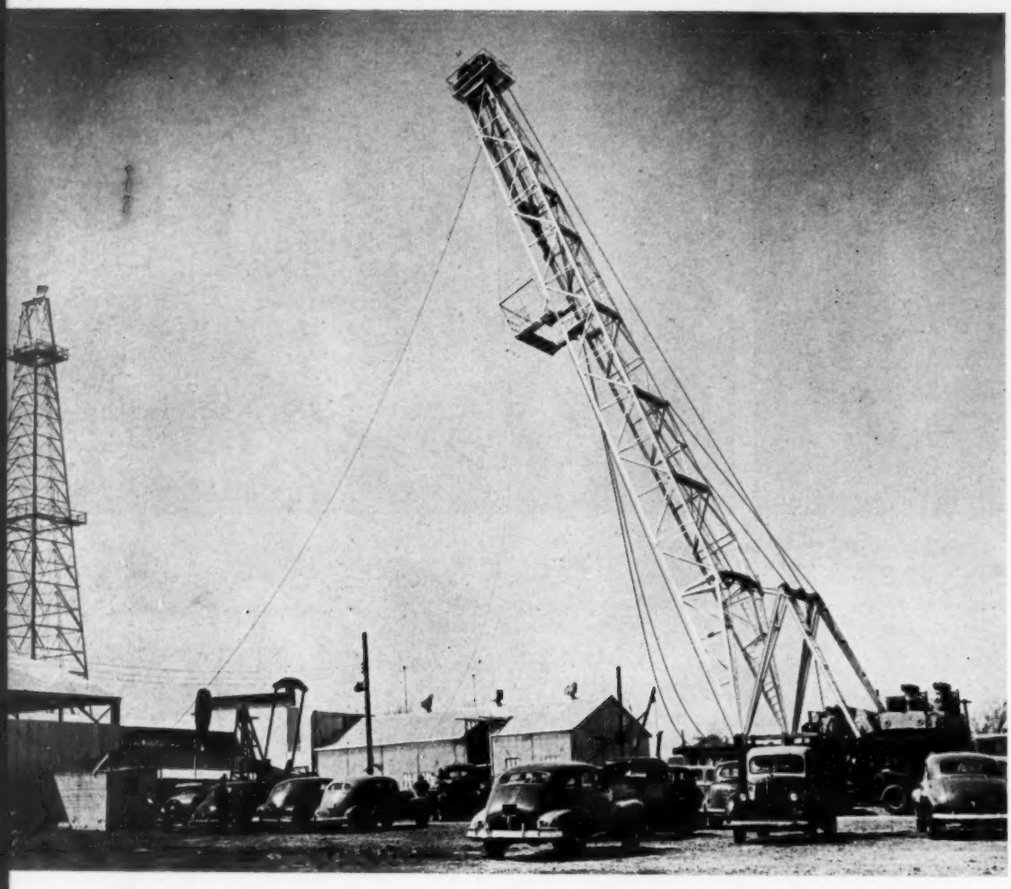
What is said to be the first completely automatic control for accurately controlling weight on a drilling bit and regulating the feed-off of drill pipe to maintain a constant bit weight is exhibited by Continental Supply Co. in conjunction with its new 1600 HP mechanical drilling rig. This new drilling control was designed and built by the General Electric Co. and is being exhibited as a cooperative venture between the two. The principle on which this new drilling control operates is simple. The total weight on the hook is transposed to torque on the drawworks drum. If a constant torque is applied to the drawworks drum, a constant amount of weight can be held or supported. If this torque is regulated, any amount of weight can be supported. Consequently if total weight is 100,000 pounds, for example, and it is desired to allow 10,000 pounds to rest on the bit and the remaining 90,000 pounds to be supported by the drawworks drum, the torque applied to the drawworks drum is reduced to the amount necessary to support 90,000 pounds.

The torque on the drawworks drum is provided by an electric motor operating through a Link-Belt gear reducer. Torque in an electric motor is regulated by the amount of electric current flowing in the motor windings. By means of an amplidyne exciter, a device which is capable of amplifying very small increments of current to large values of controlling power, an accurate regulation of current, hence torque, in the motor is obtained. This accurate regulation of torque allows accurate regulation of weight on the hook and consequently accurate regulation of weight on the bit.

The complete drilling control consists of four parts. A skid mounted motor and Link-Belt gear reducer with a connecting chain drive to a drawworks counter shaft, a main generator with a top mounted amplidyne exciter, all belt-driven over a two-to-one speed range from the mechanical rig compound unit, a small main control panel which can be set anywhere desirable and a small driller's control panel at the driller's position.

The driller at his position turns a small rheostat dial which sets a certain weight which he wants to hold on the bit, in terms of total weight on the hook, closes an electric switch, releases his mechanical brake, and the drilling control takes over and automatically maintains the preset bit weight irrespective of the rate of penetration. The drill pipe will be automatically fed off at the rate required to maintain the preset bit weight up to a maximum rate of penetration of 1.5 feet per minute. If this maximum rate of penetration at 1.5 feet per minute is exceeded, a special control device takes over and holds the rate of penetration to this maximum value. This feature is included so that in passing from a relatively hard formation to a soft formation, the drill pipe will not drop too fast for the driller to maintain control of it. This maxi-

Unit pumpers of National Supply Company's exhibit with Continental Supply Company derrick in background.



Tall drilling mast of Bethlehem Supply Company being raised into position. Standard Mid-Continent Supply Company derrick at left.

mum rate of penetration can be preset by the driller at his position for any maximum value from zero to 1.5 feet per minute.

All equipment is extremely compact, and all electrical connections are made between the four items of equipment by means of five plug and socket cable connections. Provision is made for connecting a recording instrument to the control to record bit weight and rate of penetration. This new drilling control is applicable to all types of rotary drilling rigs, either mechanical, steam or electrical.

The automatic feed-off may make it possible to use diamond core bits more generally. Diamond bits have been used with success in the Leduc area in Canada and in Central Oklahoma but have been somewhat less successful in some other drilling, particularly in chert. In one Oklahoma area rock bits were getting only about a foot of hole between trips, and at 11,000 feet this meant only about two feet of hole per day. With the rig time costing $1,000 per day, the hole was running $500 to $1,000 per foot—important money. With diamond core bits in this particular area, it was possible to make a foot of hole in 10 to 15 minutes, and drilling rate went up to 50 to 100 feet per day. One difficulty with the diamond bits is that the diamonds must be set in a relatively soft matrix, and weight on the bit must, therefore, be regulated with great exactitude.

Other types of bits also are being developed by the bit manufacturers to give more feet of hole per trip and per dollar. In the case of drag bits for drilling soft formations, a great deal has been learned lately in methods of making hole by hydraulic action of the drilling fluid rather than by the blades of the bit. Careful studies on the size, angle and type of nozzles to get maximum mud velocity and cutting action have resulted in new bit designs with outstanding results.

The turbine bit for deep drilling is not here yet, but there is considerable discussion and work going on in that direction. Reports filtering out of Russia state that the Soviets have made progress in turbine drilling by increasing the number of stages, but that they still have the bit attached to the drill pipe so that a trip must be made when bits must be changed. Aside from the ability of a turbine bit to rotate at very high speeds, the principal advantage of such a bit would be only if it could be lowered through the casing on a wire line and raised in the same manner. This would necessitate an expanding type bit so that it could drill a hole larger in diameter than the pipe. But if drill pipe can be eliminated, a new revolution in drilling practice would be at hand.

Whatever may lie in the future, drill pipe still is with us, and massive, powerful equipment must be provided to turn as well as lift and lower it. To minimize the shocks of driving the turntable, torque converters and fluid couplings are not new, although heretofore torque converters have been limited in size. Now it is reported that a 2,000 HP torque converter is available in a combined converter and coupler.

Slush pumps have been getting bigger and more powerful year by year as the demands on them have been increased. Some engineers feel that they now have reached somewhere near maximum capacity and size and that future development must be in another direction. Compounding of slush pumps either in series or parallel is possible with the aid of pulsation dempeners such as rubber cushions built to flex or air cushioning devices. Some work has been done in applying a multicylinder pump in an effort to reduce size and weight. If cavitation and some other troubles can be whipped, this type pump would permit reducing weight in half. Pump manufacturers also are working diligently on slush pump expendables such as liners, valves and seats to reduce mud pump costs.

An interesting tool for reverse circulation has been developed by Hinderliter for insertion in the drill pipe string just below the surface. It has packing on the outside which fits the surface pipe snugly. Pumping is down the drill pipe to the tool, the mud then goes on the outside of the drill pipe and down the annulus. The returns come up the drill pipe to the tool, cross over and come out at the surface in the regular mud stream. The method eliminates a lot of packers and valves required in normal reverse circulation.

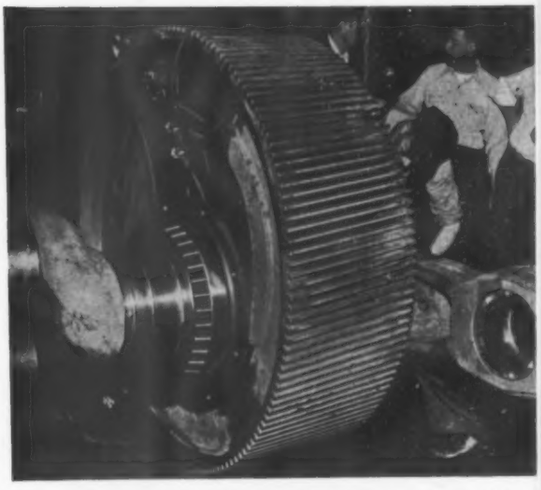
An astonishing number of portable masts are being displayed at the present Exposition. As mentioned previously, drilling equipment is being made more portable and, as a matter of fact, is being put on wheels wherever possible. Emsco Derrick and Equipment Co. has just announced, for example, a 136-foot mast with a crown block capacity of 800,000 pounds and capable of drilling to 15,000 feet.

Lee C. Moore Corp. has seven derricks at the Exposition, four of which are masts and three the foot K type. The K derricks are 140, 189 and 192-foot units. The masts range from a 65-foot automatic well servicing unit to a 136-foot jack-knife cantilever drilling mast on an eight-foot substructure.

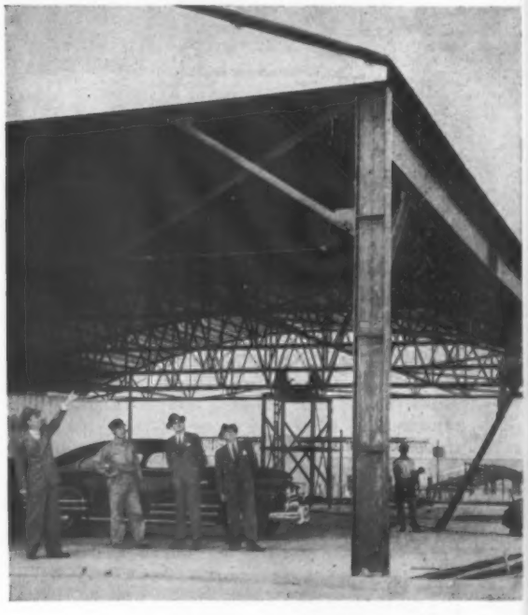
An interesting example of a portable mast is that developed for Shell Oil Co. in California and described in the April issue of WORLD PETROLEUM. This is a 123-foot, 300,000-pound load capacity derrick which can be collapsed for transportation to 8 x 8 x 64 feet. The entire rig is on wheels for quick transportation.

In the diesel engine field an interesting recent development is the dual-fuel gas-oil unit. The large size unit of this type engine, suitable for utilities and other permanent installations where fuel cost is important, is a development of Cooper Bessemer Corp. The engine uses five to ten percent diesel fuel as an igniter and the remainder natural gas. It is reported to have a thermal efficiency of about 39 percent compared with 33 percent for the ordinary diesel engine.

The original painting "Oil Transport—Before Steel" by Orison MacPherson, depicting pond freshets in action during the early days of the oil industry, is a feature of the Jones & Laughlin display. Following this display it will be presented on June 3 to the Drake Well Memorial Museum, Adam J. Hazlett, Jones & Laughlin vice president in charge of sales, will make the presentation



The massiveness of modern slush pumps is illustrated by this gear from a pump displayed by National Supply Company.



A number of exhibitors have built permanent buildings for the 1948 show. Among these is the General Motors steel and concrete building shown under construction above.

A smaller high-speed version of this unit for drilling purposes is the Cummins Diesel LI-600 as displayed by Mid-Continent Supply Co. Such an engine can be used entirely on oil when drilling a wildcat and on combined oil and gas fuel on subsequent wells where the wildcat is successful and gas available with obvious advantages on a fuel cost basis. When operating on gas with ignition by pilot injection of fuel oil, the compression is the same. The amount of this pilot injection of fuel oil is about 15 percent of what would be the fuel oil consumption if the engine were operating 100 percent on fuel oil, at full rated load of same speed. The engine, equipped for dual fuel, is started by compressed air on 100 percent fuel oil. After the engine is up to operating speed, the gas is turned on manually by moving the control lever to the gas position. This action automatically adjusts the pilot oil injection for ignition purposes. When operating on gas, the speed of the engine is controlled by throttling the gas only. The air supply and mixture are not throttled. Continuous and intermittent horsepower ratings for operation on natural gas closely follow the chart for fuel oil operation.

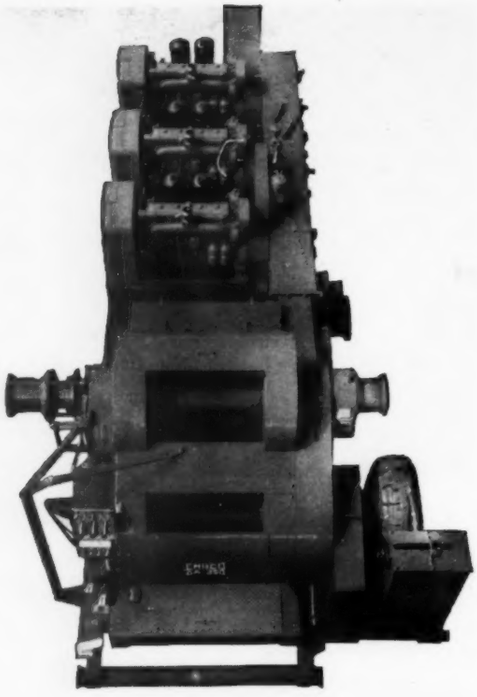
Mid-Continent is also showing the new Sheppard model 6-D diesel engine, designed to operate on crude oil and making it possible to provide power by an engine that will use crude as it comes from the well. This model is shown powering a DD-80 Emsco unit pumper.

The trend toward larger and more powerful equipment which has been apparent in the drilling division of the industry is also observed in other areas. Compressor equipment for repressuring plants and gas pipelines is featured by larger and more compact units for lower installation and maintenance. An outstanding example of this trend is the 2400-horsepower compressor announced within the past year by Cooper-Bessemer Corp., one of which is displayed at the show.

This new compressor is 50 percent larger than the largest previous gas compressor on the market. It is capable of handling up to 35 million cubic feet of gas daily in a compressor plant where the gas must be raised from 300 to 900 psig. As a booster compressor on a gas line, a unit is capable of handling up to 120 million cubic feet of gas daily where the desired pressure increment is on the order of 200 pounds.

Traditionally the Tulsa Exposition is primarily a production equipment show, but in the fields of valves and fittings the exhibits combine items for all branches of the industry. In the Scientific and Technical building are a considerable number of exhibits of particular interest to refiners and natural gasoline manufacturers. An example is the three-booth exhibit of The Refinery Supply Co. which contains 43 types of instruments used in the laboratory and for process control. The principal instrument manufacturers also are showing their latest electronic and mechanical or thermal devices for measuring and controlling operations in the field, on pipelines and in manufacturing plants.

While space does not permit a description of all the hundreds of displays at the Exposition, the following pages contain information on many of the exhibits embodying new developments or improvements on a wide variety of equipment.



Emsco Rigs

A number of Emsco drilling rigs of new design are being displayed in operation in Continental Supply Company's open-air space. Latest edition to the line is the J-1600 rig recommended for depths to 16,000 feet. The complete drilling rig consists of the drawworks, a three-speed forward and reverse selective transmission, compounding transmission, engines, pumps, appropriate bases, etc. The power is transmitted to and through the drawworks by fully enclosed chain drives. The rig number designates the recommended horsepower input. The compounding transmissions are made for use with two, three or four engines. The drives to the pumps are through Fawick AirFlex clutches and V-belts.

All Emsco J series drilling rigs have six hoisting speeds; three rotary speeds; two reverse speeds to the drum shaft and one to the rotary. The drawworks in itself has two hoisting speeds and one rotary speed. In combination with the three-speed selective transmission, the hoisting speeds are increased to six and the rotary drive speeds to three. All chain drives are lubricated from built-in oil pumps.

Emsco's GA-350 is of unitized design so that with certain engines it may be moved as a complete eight-foot road clearance package without removing the engines. The rigs are air-operated and oil-bath lubricated. The compounding transmission is a two-engine three-shaft, or three-engine four-shaft one-piece assembly, mounted on the main skid base and flange bolted to the drawworks. The shafts are mounted on self-aligning bearings and are drilled to admit air to the Fawick AirFlex engine clutches. The pump sheave is mounted on the engine side of the compounding transmission to keep the rig within eight foot road clearance. The pump countershaft is mounted on self-aligning roller bearings and is force-feed lubricated.

The drawworks has four shafts; jack shaft, line shaft, cathead or combination cathead and sand reel shaft and drum shaft. There is a built-in reverse in the selective transmission. All shafts are made of heat treated alloy steel and are mounted on self-aligning bearings. All shafts are assembled in their entirety outside the drawworks frame, and assembled in the frame as complete units. Friction clutches are mounted on the ends of the shafts to facilitate their servicing. The sand reel is optional equipment.

Well Surveying Equipment

Schlumberger Well Surveying Corp.'s booths have been planned not only to accommodate a number of the latest well surveying instruments, but also for the convenience of old and new friends as a comfortable place to relax and chat. Exhibits include the most modern photographic electric well logging recorder capable of recording the several curves presented on the standard electric log on two depth scales on one trip out of the hole. Surface controls and subsurface equipment are exhibited for all Schlumberger auxiliary services such as side wall coring, dipmeter surveys, photoclinometer directional surveys, section gauge surveys, radioactivity loggings, precision gun perforating, radioactive marker surveys, and induction logging included as an integral part of the new equipment.

Valves

Crane Co. with four booths at the show is displaying a variety of valves. Included are the new No. 3602 steel valves, the 600-pound line of cast and forged steel valves, some six-inch iron valves, a six-inch pressure-seal-bonnet valve in cross-section, and a large pipe coil to indicate Crane's piping fabrication facilities. Two motor-operated valves are on display—a six-inch 33X air-motor-operated valve for 900-pound service and a six-inch 76U electric-motor-operated valve for 600-pound service. Both valves connect to a remote control panel, which enables visitors to operate them. Literature is not distributed at the booth, but one section provides a literature request table where visitors fill out requests for technical information that they require.

Welding Fittings

Tube Turns, Inc., exhibit is devoted to a display of welding fittings and flanges and materials that are of special interest to the expanding petroleum industry. Stainless steel, aluminum, monel, chrome moly and nickel products in new sizes and wall thicknesses are shown. One new product on display is a new and improved Tee design which has been engineered to withstand pressures 25 percent higher than ratings established for conventional design. Another new product is the Tube-Turn grooved type knock-off spacer pin welding ring, shown in the accompanying photograph, which has been engineered and designed to meet all requirements for a satisfactory backing ring.

Stainless Steel

The largest combined exhibit of products and services of United States Steel Corp. subsidiaries ever presented at an International Petroleum Exposition has been assembled this year. The combined exhibit shows by means of models, illustrations, cutaway sections and full-scale samples how and where the various steels and products made by the participating companies fit into the petroleum industry to best advantage. One outstanding exhibit shows how readily stainless steel can be formed into sections frequently used in the petroleum industry, with actual demonstrations of bending, forming and shearing stainless steel strip, bar and tubular stock, forming angles and other shapes and then bending them as might be required. Other stainless steel exhibits show applications.

A tubular exhibit demonstrates the application and properties of National Tube Co. products such as drill pipe, casing, tool joints, oil well tubing, line pipe and refinery still tubes, wtih complete technical literature and supplementary data available to the visitor. A special feature shows the underground gas storage units using forty-foot sections of 24-inch seamless tubing fabricated into containers which are manifolded for use in supplementing regular natural gas supply.

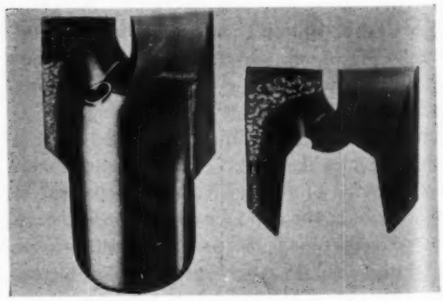
American Steel & Wire Co. presents in a compact display a complete exhibit of the special wire rope and cables. An illuminated board shows how to select the most suitable rope for an application, using fatigue bend strength and abrasion resistance as the two principal criteria, while a hand sample board allows visitors to check for themselves how different types of rope construction of the same diameter afford radically different degrees of flexibility over a standard sheave.

Micronic Filtration

Warner Lewis Co. is showing a combination separator and filter which operates in three stages. The first stage removes pipe scale and other large bodies of foreign matter. The second stage removes particles 25 microns or larger, while the third removes particles 10 microns or smaller. The consolidation of several primary operations into one package permits a saving in installation cost.

Forged Steel Fittings

The Watson-Stillman Co. exhibit points out the unique advantages to be had from forged steel fittings not only in high temperature, high pressure and corrosive service but for low and medium pressure lines as well. In addition to forged steel pipe fittings the exhibit contains a number of small standard hydraulic and mechanical tools such as hydraulic jacks, hydraulic hand-powered and power-driven pumps, portable and stationary hydraulic pipe benders, mechanical wire rope and bar shears.



Unitized Blade Drilling Bit

A feature of the Reed Roller Bit Co. exhibit is a showing of various types of unitized blade drilling bits with replaceable blades. Reed unitized blades are hard-surfaced with "Reedite" inserts and granular "Reedite," then ground to gauge on centers at the factory. No gauging, centering or grinding is necessary when inserting the blades in the bit head for welding-in. All blades have a long, hard-surfaced reaming edge. This eliminates the necessity of building up reaming lugs on the bit and hard-surfacing

them to gauge each time new blades are welded into the head. The welding spaces, or grooves, are designed so that a minimum of welding is necessary and finish grinding is not needed. Extra support for the bit plades is provided both on the blade itself and in the bit body. The bit body is fully streamlined, with replaceable slush nozzles available to accommodate any mud pump capacity or circulation requirement.

Reed also is showing super shrink grip tool joints which can be applied to drill pipe in the field by hand. In addition to the "safety area" the Reed shrink grip tool joint has a square gauging shoulder inside the tool joints upon which the end of the drill pipe lands.

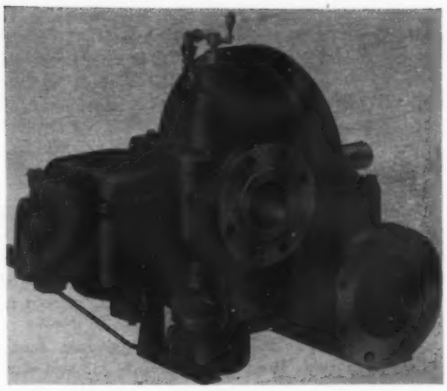
Self-Priming Pump

Against a lighted panorama background in bas-relief depicting the oil industry from field drilling to bulk stations, are displayed the Allis-Chalmers Manufacturing Company's vari-pitch speed-changer and automatic self-priming pump in operation, blower and 10,000-KW gas turbine models, an aluminum model of the solids-handling pump and an Ampac 200 arc welder with transparent front and cover to show interior mechanism. A transparent cover on the speed-changer enables visitors to view the manner in which this unit provides infinite variations of speeds through a smooth, stepless range as high as 375 percent. The operating principle of the self-priming pump, by which fast, smooth transition from priming or vacuum pumping to straight centrifugal action is possible, is demonstrated by pumping colored water through a circuit consisting of an 80-gallon Plexiglas tank and lucite tubing.

On either side of the atmospheric background panorama, two lighted three by three-foot transparencies show installation views of an Allis-Chalmers 10,000-HP turbo-generator, a 1,400-pound water conditioning system, Houdry gas turbine and blower and unit substation. Smaller color transparencies mounted across the front of the panorama show other Allis-Chalmers products employed in the oil industry.

Mechanical Drive Turbine

One of the chief features of the General Electric Company's exhibit is the first public showing of its recently announced type DP mechanical drive turbine. A working model of the governing system of the turbine is being shown. Another featured display is an electronically controlled motor-control center that has wide application in refineries and processing plants. The new turbine is expected to have wide application in oil production and processing, such as a driving medium for pumps, compressors, fans, blowers and similar equipment. It is available in ratings of 10 to 1200 HP, with speeds of 1,000 to 5,000 rpm and has been designed to include features determined from



a survey of hundreds of turbine users. The new unit includes such features of large turbines as hydraulic governing for wider speed range and more accurate control, and pressure oiling of bearings to insure positive lubrication.

The new oil-relayed governing system gives superior performance over previous mechanical governors, and the speed range has been increased to 30 percent while speed regulation has been reduced to six percent. Many parts are enclosed, and the governing system is entirely encased in an oil atmosphere, thereby eliminating rusting problems when the turbine is used in standby service. A new balanced valve design is used for the governing valve and the combined trip-throttle, valve, so that less force is required to separate the valves and a given size valve can handle larger steam flows. These valves are combined in one assembly. Maintenance of the new small turbine is made easier by the accessibility of individual components and because the great majority of parts are interchangeable on all frame sizes.

The G-E motor control center, which also is shown, is designed so that all connections can be made from the front, thus permitting center units to be lined up against the wall or in back-to-back fashion in refineries or processing plants. The center consists of standard starter units which are slid into vertical, cabinet-type sections in building block style. Starters are available in five different sizes, each starter being a fully enclosed unit which can be arranged within the vertical sections to fit the requirements of the user.

Power connections to the starters are made by clothespin type contacts which grasp vertical busses in the rear of the sections when the starters are slid into place. Control interconnections to other motors and controls are made through a special wiring trough with a removable cover which runs the length of the section. All wiring can be done from the front without disturbing the starters. Each starter has a built-in circuit breaker for short-circuit protection, the breakers being so interlocked that the doors of the sections cannot be opened when the power is on.

Diesel Engines

The Waukesha Motor exhibit centers around diesel engines for drilling, servicing, pumping and utility plants, as well as the company's gas engine counter parts. All of the engines are actual running models. The largest diesel engine is the Model WAKD, a 6-cylinder, 6¼ by 6½, 1,179 cu. in. unit, developing 190 hp., with all accessories, at 1300 rpm. The smalles is a 6 cylinder, of 3¾" bore by 4" stroke, 265 cu. in. displacement, and developing 60 hp. maximum at 2,000 rpm. with all accessories.

Pipe Mill Model

Youngstown Sheet and Tube Co. is displaying a model of its continuous weld pipe mill in cooperation with Continental Supply Co. This model uses lead "skelp" and illustrates graphically the operations incidental to the forming of the pipe. The finished pipe is approximately one inch in diameter and 32 inches long. In the background behind the model mill are displayed close sections exhibiting the section contours of the "skelp" immediately after it emerges from the stand of forming rolls.

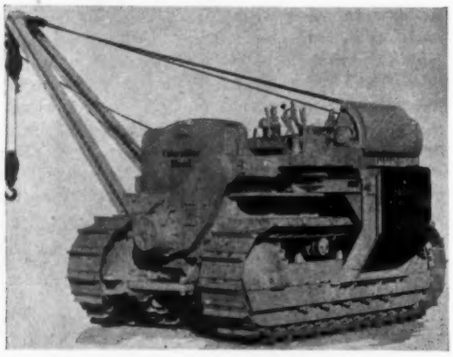
Sump Pump

The new Gardner-Denver VP4 sump pump shown by Continental Supply Co. has top suction and hence will not dig in and bury itself in the mud. The top-suction design eliminates breaking of the pump shaft seal because of water pressure. In the VP4, the oil seal is subjected only to a static pressure from depth of immersion when not in operation. When the pump operates, water cannot reach oil seal or air motor. A built-in governor idles the pump automatically when suction runs dry.

Multiple Engine Rig

Mid-Continent Supply Co. is showing a multiple engine rig and pump drive powered by six 240 HP at 900 rpm for drilling to 20,000 feet. Swinging compounds interconnecting each dual engine unit have no chains to disconnect and no guards to remove when moving from one location to another. The whole group can be transported on three trucks without removing skids. Assembly can be converted into power groups of two or more engines without additional parts or scrapping of any part of the original assembly. Engines are controlled from driller's position. Any engine can easily be removed from operation temporarily for servicing or repairs without interrupting the functioning of remaining units. When

the power group is disassembled for transportation, the special swinging compound is raised to a vertical position after the halves of the gear tooth flexible coupling have been unbolted. Then each of the two-engine units, mounted on oil-field type skid, is loaded onto a truck. Each unit is only seven feet, three and a third inches wide. The pivoted swinging, compound remains locked in the vertical position for transportation.



Tractors

Caterpillar Tractor Co. has rebuilt and redecorated its building for the display of a large group of engines and tractors for various purposes. Included are pipelayers, bulldozers, towing units, excavators and graders. Most of the engines for mobile units or for electric generators are diesels.

A. O. Smith Products

In its exhibit the A. O. Smith Corporation, Milwaukee, Wisconsin, is using what it terms a "Family Show" motif. The company is displaying most of its products that serve the petroleum industry. These include pressure vessels, auto frames, line pipe, casing, meters and welding electrodes and equipment. Also on display are liquid gas systems and LPG automatic storage water heaters. Of considerable interest is the work that has been done by A. O. Smith in introducing standard specifications in the making of pressure vessels.

A. O. Smith has successfully applied standard procedures to such mass-produced items as auto frames, line pipe, casing and even such "vessel" fabrication as liquid gas systems, multi-layer penstocks and glass-lined brewery storage tanks. The company, using this background of experience, has now worked out standard specifications for purchasers of vessels. The company has also taken some interesting steps in the field assembly of vessels. The trend, of course, is toward larger vessels that are beyond the limits of railroad shipping and clearances. A. O. Smith, in seeking to transfer shop quality control to the field, offers two ways by which it will give the same guarantee that would be given if the vessel were made in its shops.

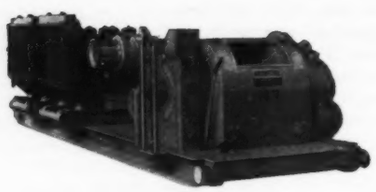
Tube Cleaners

Airetool Manufacturing Co. is displaying nearly 150 items. In addition to its line of tube cleaners, tube expanders and certain oil refinery specialties, many new pieces of equipment developed by Airetool since the last oil show are on display. Among the newer items shown are three models of powerful outside mounted cleaners for cleaning heat exchanger and condenser tubes which range from ⅜ to 2½ inches in size. These cleaners quickly clean tubes that are completely closed or lightly scaled. One of these No. CC-450, is a direct drive cleaner that weighs only 21 pounds and may be used with or with a supporting rig. The various types of drill heads used with these cleaners will also be on hand. Other new items include a right angle gear drive which is used for driving expanders where the handhole is at right angles to the opening; knock-out tools for removing stub ends when retubing bundles; a newly designed parallel gear train; and many other pieces especially designed for certain jobs.

Aluminum Pipe

Aluminum pipe, one of the most discussed and investigated items in the petroleum industry, is featured at Aluminum Company of America's exhibit. Welded joints and mechanical couplings of aluminum are offered to demonstrate the practicality of aluminum for gathering and distribution pipelines. The display includes aluminum and magnesium galvanic anodes used in protecting buried steel pipelines and structures. The new insulated aluminum wires and cables, which were approved for Underwriters' Laboratories seal of approval late in 1946, are given considerable prominence. Other electrical conductors such as ACSR (Aluminum cable steel reinforced) and bus bars, as well as many electrical fittings made of aluminum, are on display.

The chemicals division of Alcoa is showing a new ball form of tabular alumina for use in pebble heaters and as a catalyst support. Activated alumina for drying liquids and gases, and catalysts containing alumina complete the exhibit.

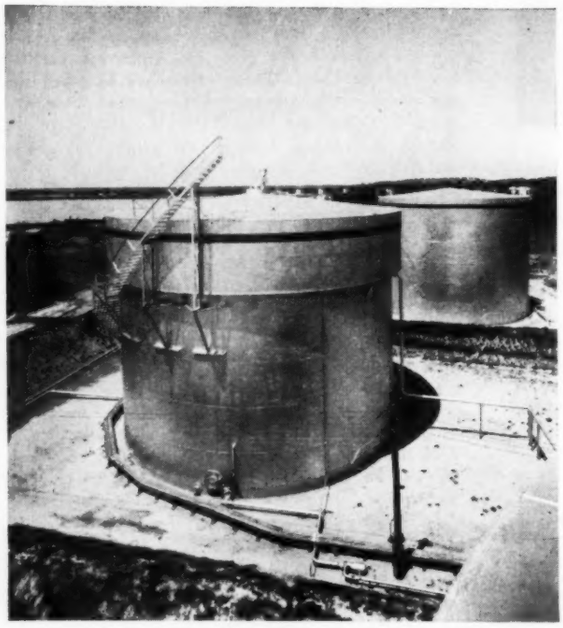


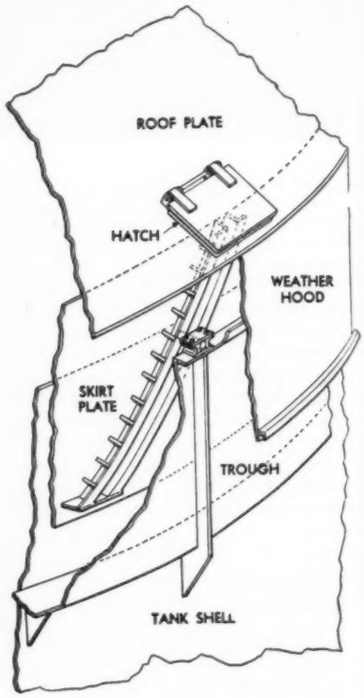
Brewster Rotaries

The Brewster Company's exhibit consists of draw-works, rotaries and hook and traveling blocks. The skid-mounted rotaries range from the new N-2 for drilling to 2,000 feet or servicing to 6,000 feet, to the RS-22 designed for drilling to 12,000 feet.

Automatic Pipe Line Equipment

An automatic tank shut-off valve designed for use in pipe line gathering systems is being shown by Stentz Equipment Co. This valve eliminates air bleeders, operates wide open and tanks are completely empty when it automatically closes, assuring immediate and tight shut-off. When used with the automatic shut-down switch, pipe line gathering system tank runs become completely automatic. The use of these controls permits the gathering system to remain completely filled with oil at all times, which eliminates vapor locks and reduces pipe line maintenance.





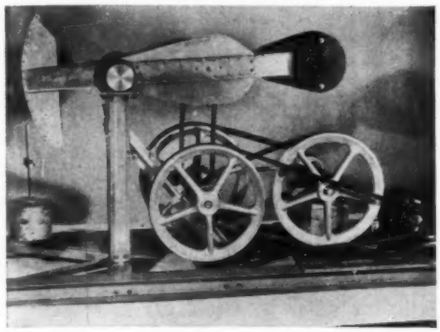
Liquid Seal Lifter Roof

Chicago Bridge and Iron Co. is featuring the Horton liquid-seal lifter roof at its exhibit. This is a single-life, spiral-guided gas holder mounted on and forming an integral part of an oil or gasoline storage tank. It provides an expansible vapor space which permits the air-vapor mixture above the stored liquid to expand and contract, thereby reducing loss of vapor through the roof vents. When rising temperature causes the air-vapor mixture to expand in a lifter-roof tank (and in the fixed roof tanks connected to it,) the roof moves upward. When the vapor contracts, the roof rides back down on the vapor. This adjustment in air-vapor mixture volume eliminates breathing loss. The lifter-roof will also utilize any surplus capacity to reduce filling losses.

Horton lifter-roof tanks may be used individually or they may be connected to one or more adjacent cone-roof tanks, by large-diameter light-weight piping to form a vapor-saving system. The roof proper consists of an ordinary cone roof with two depending concentric rims at the periphery. The roof is slightly larger in diameter than the tank, and the inner rim fits into a trough attached to the outside of the tank shell at the top. This trough, which extends all the way around the tank, is filled with a sealing liquid that prevents vapor from escaping. The liquid in the trough allows the rim of the roof to move up and down freely and at the same time maintains a gas-tight seal regardless of the position of the roof. The outer rim serves as a weather hood which keeps rain, snow and dirt out of the trough. When a Horton lifter roof is in the low position, it is supported on rafters similar to those used in a tank with fixed roof. When the pressure in the vapor space increases, the roof is lifted off the rafters. As it rises, it is rotated slowly by spiral guides mounted at an angle of 45 degrees on the skirt plate. Horton lifter roofs are recommended for tanks 25 feet or more in diameter which are filled or emptied not more than about six times per year.

Turbo-Jet Mud Mixer

A-1 Bit and Tool Co. is showing a Turbo-Jet mud mixer which operates below the surface of the fluid in the suction pit and is so designed that fluid circulates through it, with a resulting turbulence that completely and thoroughly mixes and combines the fluid and all materials added to increase the weight. In operation a discharge line from the pump is connected to the jetting fixtures, and when pump pressure is introduced, it creates a partial vocuum inside the barrel and fluid is drawn into the mixer through three ports in the barrel. This fluid is expelled by the discharge pressure at the jetting nozzle, creating turbulence over the entire pit area. As the mixing operation continues, all fluid in the pit receives the treatment with the result that mud weight and viscosity are uniform at all depths throughout the pit.



Pumping Unit

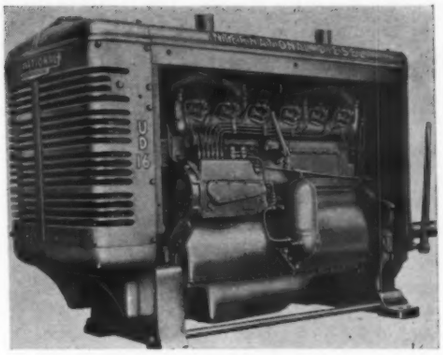
A radically new type pumping unit which can be operated as a conventional pumper or as a cycling pumper is being displayed in working model form by the Baroid Sales Division of National Lead Co. As a stroke cycling pumping unit, the Keltner pumping unit can be made to operate so that each stroke is successively greater or less than the preceding stroke, depending upon the period of the cycle. This has several outstanding advantages over a pumping unit equipped with an electrical intermitter. The unit will cycle regardless of whether the prime mover is electrical or internal combustion. The cycling action distributes wear over the polished rod, sucker rods and the pump barrel. No sudden heavy load is placed upon the prime mover. Constant movement of the rods checks trouble from floating sands. The new pumping unit is surprisingly simple in construction.

Baroid also is exhibiting a number of its other equipment specialties as well as its principal line of drilling and materials, mud testing equipment and well logging service. Specialties include the Autotrol oil and gas separator which has been field-tested for four years. Autotrol separators embody a radically different means of controlling gas and oil flow. The Autotrol system has no stuffing-box and no moving parts within the tank. Differential pressure of the gas and oil within the tank, acting upon an enclosed disphragm outside, actuates the flow of gas and oil. Also shown are Baroid replaceable insert-type drill pipe wipers and V-belt shock absorbers.

International Harvester

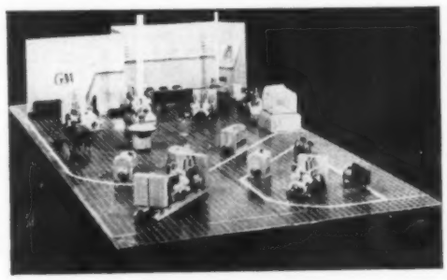
The International Harvester products exhibit at the Exposition grounds is only part of the huge display prepared by the company for visitors. Three adjacent areas in downtown Tulsa provide sufficient space to show more than three times as much equipment as can be shown on the company's 6,300-square-foot area at the Exposition grounds.

The combined exhibits on display at the two locations include 19 crawler tractors and seven wheel tractors, from the smallest available anywhere right up to the huge new TD-24 crawler, are shown mounted with almost every type of matched equipment used in the



oil industry. Eighteen power units, both diesel and carburetor type, representing capacities from 10 to 180 HP, are exhibited with various power take-off attachments and bases. Thirteen trucks with gross vehicle weight ratings from 6,650 to 65,000 pounds and capacities from 82 to 200 HP, with oil field bodies and equipment for application in the oil fields, are on display. In addition, more than a dozen International trucks are being shown as vehicles for various manufacturers' equipment at other exhibits throughout the grounds.

The exhibit at the International space on the Exposition grounds includes five diesel-powered crawler tractors with matched equipment, three diesel power units, four carburetor-type engine power units and six trucks with matched equipment. A new product is the TD-24 crawler tractor with "planet power steering" which permits both gradual turns with power on each track and pivot turns with one track locked and the other under full power. It also permits an instantaneous shaft between high and low range in any gear of the four-speed, synchro-mesh engine transmission without de-clutching the engine. This provides eight speeds which can be applied in either forward or reverse by means of a separate forward-reverse shift lever. The foot-operated, hydraulic engine clutch knocks out the hard work in de-clutching and leaves the operator's hands free for shifting on the go.

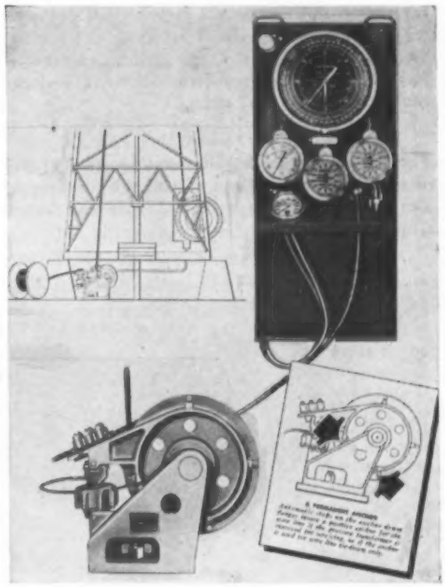


Diesel Engines

A diversified selection of diesel power units suitable for almost any type of oil field production work is being presented in the Detroit Diesel Engine Division, General Motors Corp. exhibit. This display includes models ranging from 49 HP two-cylinder single engines up to 600 HP Quad 6 multiple units. The multiple engine combination construction feature has been made possible by the Series 71 symmetrical cylinder block which permits principal accessories to be mounted on either the right or left-hand side. The units demonstrate how extremely high horsepower output and maximum portability can be realized by grouping small high-speed engines. Items such as these are most important to deep well drilling contractors when moving from one location to another. A twin four-engine (model 8-103) which is being shown for the first time consists of two four-cylinder diesel engines mounted side by side on a common base and geared to a single output shaft. The 170 continuous BHP developed by this multiple unit fills a gap between single six-cylinder and twin six models.

Microflo Control Valves

The Hammel-Dahl Co. is featuring its microflo control valve with spline plug which can handle flows in cc's with pressure drops in thousands of pounds. The basic element of the valve is a solid stellite valve plug which is a honed fit in a solid stellite seat. Clearances between plug and seat cannot be measured by ordinary methods, yet galling does not occur because of the type metal used. Fifteen sizes of valves below ⅛-inch in capacity are also being shown. These valves will permit control of flow in cc's at 1,000 pounds pressure drop. These spline plugs are being currently used in commercial applications at operating pressures of as high as 15,000 psi. Former valve life in this service averaged about one week, but the new valves are averaging better than six months of satisfactory service.



Weight Indicator and Wire Line Anchor

Martin-Decker Corp. is showing a new weight measuring method developed in collaboration with the National Supply Company. A dead end wire anchor is used in the method to actuate a hydraulic pressure transformer, which in turn transmits pressure to operate the weight indicator. Wire line anchor and weight indicator combine the elements of the wheel (for anchoring the wire line) and the lever for measuring the load on the wire line. A gauge at the driller's position registers the force on the lever which is transmitted to the gauge through the hydrulic pressure unit. The load on the hook is shown directly in pounds by the gauge.

The new Mortin-Decker type D weight indicator also incorporates several completely new and revolutionary developments in indicator instruments. Accuracy is not impaired by atmospheric temperature changes, small amounts of air or fluid volume in the system. No adjustment is required for different cable diameters from one to one and a quarter inches or for reeving. A total load-hydraulic pressure chart produces a straight line characteristic, thus permitting the use of direct gauge readings for net weight on the bit.

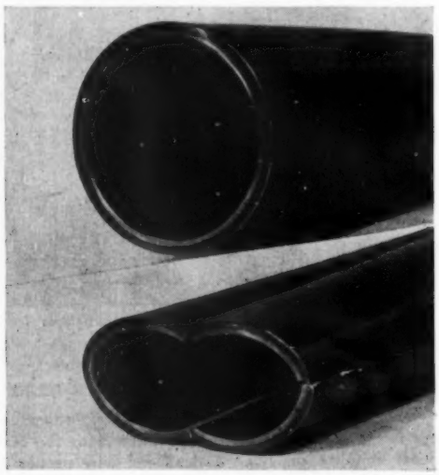
Bumper Safety Joint

Shaffer Tool Works is showing the Shaffer-Waggener bumper safety Joint, an entirely new type of tool for protecting drill strings on modern deep well operations. This tool combines in one device a quick operating pumper sub and a new type of safety joint that is the strongest, not the weakest, joint in the drill

string. The bumper safety joint incorporates a unique mechanism that locks the bumper sub in the open position at all times until weight equivalent to approximately 2,000 ft. of drill pipe is placed upon it. This weight placed on the tool trips the mechanism and allows the bumper sub to strike a sharp jar-down blow automatically. The tool can be quickly reset by simply raising the string a short distance, whereupon the mechanism resets and again locks the bumper sub in the open position until it is desired to strike another blow. Thus, down blows can be struck repeatedly and continuously until the stuck drill string is loosened.

In the event that the stuck string cannot be loosened, the safety joint can be released by simply placing the tripping weight of drill pipe on the tool to trip it and then applying a slight reverse torque in the drill string. By first tripping the tool, then applying slight reverse torque while the tool is slowly raised, the driving keys are rotated into a releasing slot similar to that on a "J" tool, whereupon the upper portion of the tool can be released from the lower portion by merely raising the drill string.

The tool may be used while rotating the drill string in either direction without risk of releasing the tool. Yet, whenever release is desired, operation is quick, simple and foolproof.

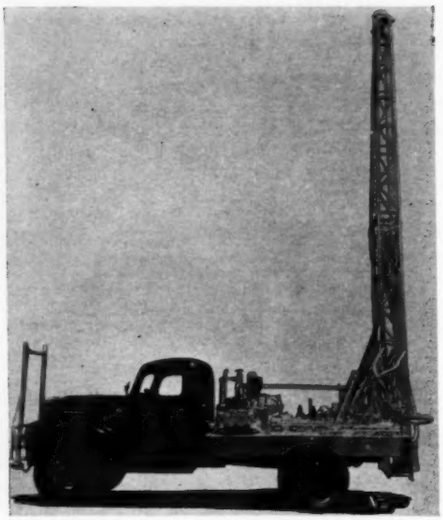


Alloy Pump Liners

Axelson Manufacturing Co. is showing its new Duax pump liner at the Jones and Laughlin building. Developed after several years of research, this new product is manufactured by a new process whereby specially alloyed iron, which is as hard as fine tool steel, is centrifugally cast into seamless steel shell, using a patented method which assures an absolute bond between the two metals. The extremely hard inner surface of the liner offers high wear-resistant properties, while the tough outer steel shell prevents any possibility of the liner cracking due to brittleness. Careful "magnaflux" inspection of each liner insures uniform quality and eliminates any below-surface flaws either in the casting or in the bond between the cast iron and steel. Stainless steel pumps and highly alloyed balls and seats of great strength and toughness also are shown.

Hydraulic Drilling Rig

International Derrick and Equipment Co. is showing a hydraulic drilling rig as a part of its very complete exhibit. This rig is designed for drilling a three-inch hole to a depth of 1,000 feet by hydraulic power. The unit is truck mounted and is a completely equipped drilling machine. Outstanding features of the rig are the rotary table of unique design that is driven by hydraulic motors and is raised and lowered



in the mast by hydraulic operated cylinders—the hydraulic driven hoist—and special swivel that functions as a fluid connection only. No kelly is required for drilling. Pipe is connected directly to the table. Pressure on the bit is automatically applied by the hydraulic cylinders. The rig is smooth and extremely fast in operation.

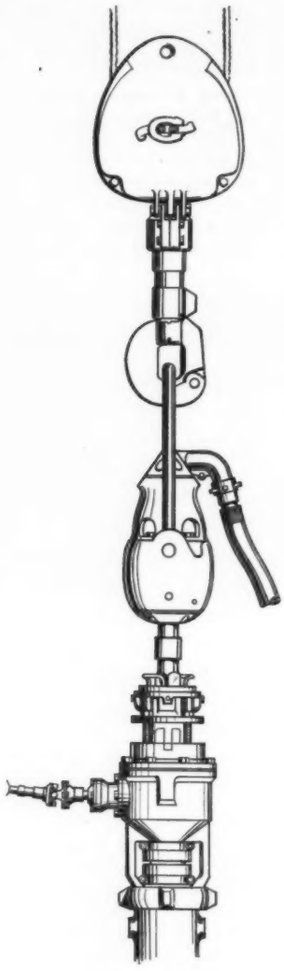
The T-750 steel triplex slush pump being exhibited has a maximum mechanical HP input of 750 at 56 rpm, and the pump delivers 975 gpm at 1200 psi with a 7¼-inch liner. Cylinders are 7½-inch in diameter and the pistons have a 15-inch double acting stroke. The pump weighs only 35,000 pounds, and its dimensions are within road limitations. Field tests have proved the pump under varying operating conditions.

Ideco is also showing its No. 40 spudder designed to drill to depths of more than 5,000 feet. The machine is powered by a standard six cylinder engine equipped with a two forward speed and one reverse speed transmission. Bull reel, sand reel and casing reel are gear driven, and an automatic spooling device is provided for the bull reel. Mast is power raised, is telescopic two piece, all steel, and provides a 56-foot working height. Controls are centralized.

Portable Welders

Westinghouse Electric Corp. is featuring an all-steel Life-Line motor, an airbreak combination linestarter for hazardous locations and portable a-c and d-c welders. The Life-Line motor has sealed pre-lubricated ball bearings said to provide effective lubrication for five years or longer without requiring attention. Drip-proof, splash-proof, totally-enclosed fan-cooled and explosion proof models are shown.

The new a-c Flexarc welder being shown overcomes the problems of arc instability which formerly limited the use of lower a-c voltages for welding. It is designed to operate with an open circuit secondary voltage of only 65 volts. Built-in capacitors help provide more efficient operation. The d-c "Ranger" welder is a small sturdy engine-driven welder capable of making "shop" quality welds on field jobs where power is not conveniently available.



Guiberson Specialties

The Guiberson Corp. exhibit features a hook-up which is made up of the unitized tubing block and hook, the new swivel and the Type "J" drilling head. All are products developed by the company since the last oil show and are exhibited for the first time in Tulsa. Additional booths in the Guiberson exhibit contain sections devoted to swabbing equipment, tubing catchers and anchors, a packer display and one on the several types of drilling and swabbing equipment long prominently identified with the company.

The Guiberson Type M heavy duty swab is designed to pick up the heaviest columns of fluid in low-pressure deep wells. The swab assembly features a seamless steel tube mandrel with a large fluid passage and is equipped with a shear, disk-type overload releasing valve. Cups are constructed on the basket-type principle, with cup thimble and reinforcing wires made in a one-piece unit. Cups automatically adjust to take up wear and are easily and quickly changed.

Guiberson is showing tubular pars for swabbing by means of which the operator is able to jar up or down if the swab becomes stuck in the tubing, or help start a new set of cups down the hole. Construction is such that considerable swivel or knuckle action is obtained, giving added life to cups.

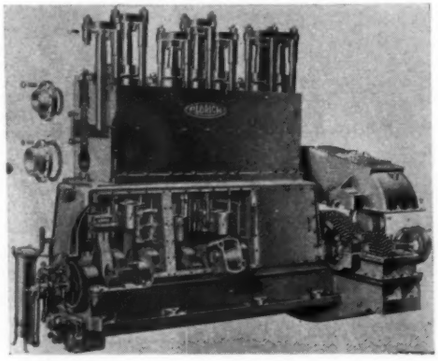
A new Guiberson tool is the Type M duplex valve designed to provide circulation between tubing and casing and to furnish a fluid by-pass in emergencies and for special needs. When run with solid head

packers, it provides all the features of a control head packer and may be installed directly into the packer head or placed several joints above to prevent settlings from covering the valve and stopping circulation. It is used also wtih cup type packers. The valve is constructed with a sliding seamless steel mandrel which is keyed to permit a half-turn within a splined coupling for closing when desired. This allows the valve to go into the hole locked open. The valve has a control with two sealing elements, a special resilient multi-ring sleeve made of an oil-resistant compound, and a conventional tapered seat. Each seals independently of the other.

The new Type J drilling head is a major improvement due to the use of a completely new packing assembly which may be replaced without the use of special tools. This has been proven in actual field tests to last considerably longer than conventional packing. Power is delivered to the drive shaft through a flexible coupling or universal joint from a gas engine or an electric motor or the drawworks shaft. Direct transmission or V-belts can be used, depending on speed of driving element and speed desired of the drilling head.

Coring Bit

Security Engineering Co. is showing a new bit designed to be used as a regular rock bit as well as a coring bit. The bit drills through the formation, a core enters the hole in the bridge of the bit and passes through the core barrel until it reaches the core window. Here, the top of the core is broken into small pieces and ejected into the mud stream to mix with the other cuttings from the bit. When the bit is pulled, the last three feet of formation is retained in the core barrel by a core catcher. At the surface the core sample is available for immediate inspection. One coring drill collar is required for each well using this coring equipment.

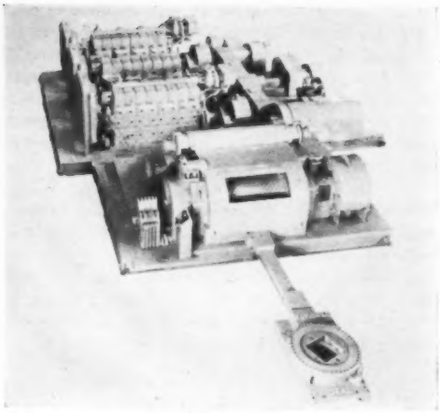


Pipeline Pumps

Aldrich Pump Co. is exhibiting an inverted triplex pump recently developed for water flooding, salt water disposal and other service such as pipeline pumping. In the accompaning cut the pump is shown dismantled for ease of inspection. Visitors are being told especially that Aldrich has simplified its design to the point where two sets of wearing parts are all that is necessary to stock for pipeline pumps ranging in capacity from 300 to 2450 HP. A pump especially built for product pipeline pumping, the controllable capacity "Powr-Savr" also is being shown.

Spiral Welded Pipe

Armco spiral welded pipe for such purposes as line pipe, casing and conduit, including equipment for lining up the pipe, field coating and wrapping procedure and wrinkle bending are being shown by Armco Drainage & Metal Products, Inc. Many items for use in the oil fields, produced from Armco stainless steel, including well screens, Christmas trees, tubing hangars and measuring lines are displayed.

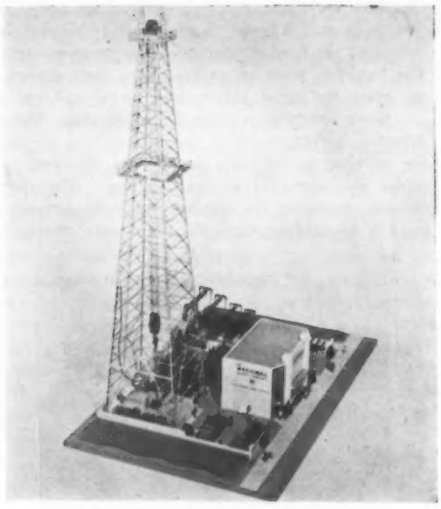


National Supply Exhibit

Over 40 carloads of machinery and construction material have been used by the National Supply Co. in developing its display of products which covers an area 80 by 120 feet. The central feature is a new two story steel and stucco building of modern design completely air conditioned, with large seating capacity and unusual lighting features. Construction of this building was started last December. Around the outside of the building are grouped the newly developed additions to National's complete lines of drilling and producing machinery. Part of the space is being used to demonstrate the complete family of pumping units, all operating in unison. The 12 basic units for all depth wells range from 6,000 to 456,000 peak torque rating.

National also is showing the largest and smallest drilling rigs in its line, both of them new developments. The type T-25 consolidated rig features the use of a twin disc torque converter and Fawick airflex clutches. It has a nominal depth rating of 4,000 feet using 4½-inch drill pipe, with 250 HP input.

On one corner of the lot, a 189-foot Lee C Moore derrick has been erected containing National's latest contribution to ultra deep drilling, the new Ideal type 160 consolidated rig for 16,000 foot drilling with 4½-inch drill pipe. Power for this rig is furnished by a three-engine sectional supercharged diesel drive having a combined output of 1,860 HP at 900 rpm. Gyrol fluid drive is featured. Slush pump is National's new type E-700 8½ bore x 16-inch stroke power slush pump which will develop a 700 hydraulic horsepower unit. Crown and traveling blocks permit 12 line reeving strung with 1½-inch diameter Roebling drilling line. The Ideal type 660-T traveling block and type 760-TD crown block are the largest ever built by National. The traveling block and the new E-54 connector are rated at 540 tons capacity, and the total capacity of the crown block is 630 tons.



Inside National's building are displays of pump parts, tubular products, drill collars, sucker rods and a large and attractive institutional exhibit. One of the major inside displays is that of Spang-Chalfant's new double seal shrink thread drill pipe and tool joints. On display for the first time is Spang special purpose plastic coated drill pipe and tubing, developed to resist corrosion fatigue in drilling operation.

Well Pressure Recorder

A pressure bomb with a surface recorder which will save oil producers from two to five hours on each test made, for either waer shut-off or production, is being shown by the McCullough Tool Company of Los Angeles. The bomb is now in use in California oil fields. It differs from previous recorders in several respects. Instead of having the pressure recorder installed below the packer down in the casing, the recorder is above ground where all pressure variations which occur during the test are instantly registered in clear view on a chart. The chief saving in time is that while the sub-surface recorder must be brought to the surface and examined before any further progress can be made, the surface recorder enables the operator to get the next operation under way immediately while the tester is being withdrawn from the well. It is at this point that a saving of time ranging from two to five hours, depending upon the depth of the testing points (in extreme cases, as high as eight hours,) is effected.

Chemical Service

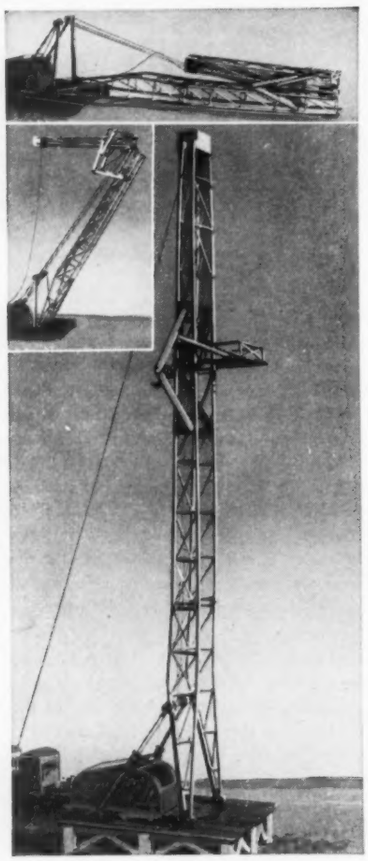
Dowell, Inc. has erected a modernistic permanent steel and concrete buildign with 3,400 feet of floor space to display its chemical and corrosion protection services to the oil industry. These include oil well acidizing, chemical scale removal from heat exhangers and cathodic protection of pipelines. One phase of the exhibit is concerned with selective acidizing and methods of conducting permeability surveys with the electric pilot.

Directional Recorder

Technical Oil Tool Corporation is showing a new directional recorder which is entirely mechanical and produces a permanent record of inclination and direction on each run. The recorder is designed for dropping down the drill pipe, coming to rest and recording in a section of non-magnetic drill collar above the bit. It can also be run on measuring line, sand line, or when recovering a wire line core barrel.

The directional recorder utilizes the same plumb bob suspension principle as the Totco inclination recorder

to assure maximum sensitivity and quick settling to true position. A small but powerful compass bar maintains the head of the pointer at magnetic north. The record is made on an aluminum chart shaped to the exact radius of the pointer travel and can be read immediately on opening the instrument. The instrument is very easy to operate and is prepared for running in the same manner as the Totco recorder for controlled vertical drilling. The timing element can be set for any interval to 80 minutes, so there is no need to hurry the preparatory work.



Jack-Knife Derrick

Franks Manufacturing Corp. is showing a new double jointed, 130-foot, thribble, jack-knife derrick with 16-foot base. It can be folded into a single load for offset or location-to-location moving, complete with lines and block strung and ready for immediate erection at new location. For over-highway moving, the Franks derrick folds into two parts, each section making a single truck load. Features include: pipe racking board which never has to be removed; design which eliminates guy lines; derrick which does not have to be snubbed with winch truck or lines; use over any drawworks; traveling block hook and drilling line which are strung up at all times and are used to raise and lower the derrick through power of drawworks.

Super Cementer

Halliburton Oil Well Cementing Company has erected a 30 x 60-foot structural steel building to display the super-cementer truck. Inside the building the central theme is a 60-inch world globe symbolic of the Halliburton worldwide service. Main Halliburton locations are indicated by colored lights flickering on and off on the globe. Scale models of Halliburton trucks are mounted on a plane revolving about the globe. The Halliburton slogan, "We'll Get There Somehow" is placed in raised letters on the pedestal which serves to support the globe. The entrance is designed to provide an inviting partial view of the show through a screen of illuminated lucite rods and a global pattern executed in lucite which serves to introduce the unifying theme of the exhibition—the Halliburton worldwide service as depicted by the new trademark. Individual displays are linked to the central theme display through radio beams at the ceiling which extend to develop into partitions. Aisles, wall sections and display areas have been angled to obtain the greatest visibility for displays and to assist in directing traffic and create pleasing space divisions.

Displayed in the different divisions are: formation testing equipment; floating equipment; removable and drillable squeeze packers; multiple stage tool; measuring devices; open hole caliper tools; side wall coring tools; gun perforating tools; acids and plastics; roto wall cleaners; casing centralizers and numerous other service tools and sales items.

Steel Products

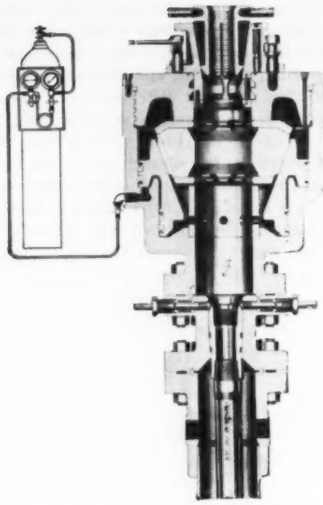
Republic Steel Corp. is showing products of its pipe division, alloy and stainless steel division, steel and tubes division, bolt and nut division, Niles Steel Products Division, and from the Truscon Steel Co., subsidiary. Items manufactured by customers of Republic Steel shown include bubble caps, barrel tube bushing, rock bits, pump liners, fishtail bit, screen pipe, tongs, still tubes and weldless jars.

Mechanical Well Logging

The Geolograph displayed in the Scientific & Technical Building is a drilling instrument which logs the depth, rate of penetration, in minutes per foot and downtime, mechanically while the well is drilling. In this device footage is plotted against time as a constant so that most formation breaks are shown to the nearest foot by a marked change in the spacing of the foot marks on the chart. A second, parallel, contemporaneous record is made of all connections and downtime which affords a depth datum check at approximately 30-foot intervals.

Electronic Temperature Recorder

The Eastman Oil Well Survey Co. exhibit includes the demonstration of a new electronic surface-recording instrument featuring a thermal unit which has proved to be more sensitive to minute thermal differentials than any type of element previously used in oil field service work. The recorder was developed to eliminate thermal lag and permits temperature surveys to be recorded at rates in excess of 300 feet per minute with less than one percent error attribuatble to thermal lag. The Eastman electronic unit has been calibrated to record over a temperature range of 30°F to 430°F using a tenth-inch chart division per degree of temperature change. All recording is done automatically, and the temperature readings are made directly on the recording strip to eliminate mathematical calculations. A temperature differential of .05 percent of full range can be readily detected, a sensitivity of temperature differential of 0.2°F.

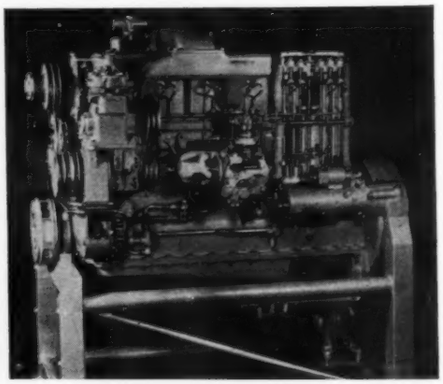


Blowout Preventer

The Hydril Co. is showing two new products, an automatic accumulator unit for maintaining a supply of high-pressure fluid for blowout preventers and a tubing stripper which functions as a blowout preventer, stripper and full-closing emergency gate valve. When mounted on a suitable tubing head, it allows the tubing string to be raised or lowered under pressure with complete safety. The type GKS tubing stripper has a wide pack-off range which permits suitable tubing hangers to be stripped through the closed packing unit. Combination strings can be handled in high-pressure wells. Although large-diameter tools may be passed freely through the unit, it is capable of instantly packing off the open hole against extremely high pressures. The unit can be conveniently and efficiently operated with bottled nitrogen or carbon dioxide gas, as shown in the illustration. Tubing control assembly, which can be quickly installed on or removed from the stripper head, consists of a split tubing spider, conventional slip assembly and collar-catching jaws capable of positive engagement to prevent pipe from being blown from the hole by high well pressures.

Atmospheric Coolers

The Happy Company is displaying atmospheric vertical air draft coolers for cooling engine jacket water, lubricating oil, gas and condensing steam. Erection of these units is simple, as the fan support with right angle reduction unit, shafts and entire frame are prefabricated as one complete unit at the factory.



Diesel Engines

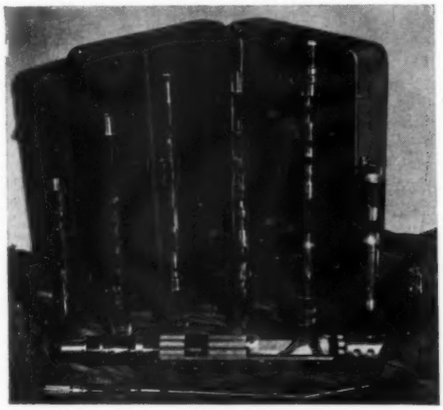
An activated, cutaway version of a model NHBS-600 is featured in the display of 13 Cummins diesels representing nearly every oil-field application. The display

is divided between the Mid-Continent Supply Company's building and an adjoining lot where Cummins-powered equipment is in operation. In addition to the activated, cutaway Cummins diesel, the interior exhibit includes a cutaway model of the exclusive Cummins fuel pump and an exhibit of Cummins fuel pump parts.

The new Mid-Continent Cummins multiple engine rig and pump drive group is on display and in operation on a 140-foot rig in the outdoor exhibit. This unit consists of six compounded model LI-600 Cummins diesels, each developing 240 HP at 900 rpm, a total of 1440 HP. Patented swinging compounds give this group a high degree of flexibility. A complete location change can be accomplished in an easy three-truck-load haul.

Hercules Motors

Twelve different models of power units and engines are exhibited by Hercules Motors Corp. One of the largest is the model HXE closed type six cylinder power unit which has a 5¾-inch bore and six-inch stroke and a piston displacement of 935 cubic inches. One of the latest Hercules developments is the model DNX-V8, an eight-cylinder base type power unit. This is the commercial outgrowth of a 32-cylinder engine Hercules Motors Corp. built for the Navy during the war.



Cutting and Fishing Tools

Motion pictures and working models are being employed by Houston Oil Field Material Co., Inc., to illustrate construction and operation of its line of cutting and fishing tools, including devices for sidewall coring. A display of various types of Hughes Tool Co. bits also is included. Carrying out the idea of providing a complete explanation of its equipment, the company is showing a working model of a gas dehydration unit built to 1/15 scale. Newest addition to the Homco line being shown is a traveling pipe inspection laboratory. Full scale demonstration of cutting and fishing tools is being made on a test rig in the open-space exhibit.

Swivel Joints

New products exhibited by the Chiksan Co. include extra high-pressure swivel joints for pressures to 12,000 psi, made of forged steel; and forged steel swivel joints for pressures to 3,000 psi. All swivel joints are shown in new color-code for identification as to pressure capacity.

Reducing Ells

Ladish fittings in action depicted with the aid of the illuminated transparencies of major installations is the theme of the Ladish Co. exhibit. Murals on each wing of the exhibit illustrate the research and testing activities that comprise Ladish controlled quality and the huge stocks that assure prompt service. Samples of

the complete line of seamless welding fittings, forged steel fittings and forged steel flanges in stainless and alloy steels as well as carbon steel are on display. Also on display are a number of forgings used in the petroleum industry. Samples of the new Ladish seamless reducing ells—the first to be entirely seamless—are exhibited. Available in most sizes, this new fitting eliminates the necessity of using an elbow and a reducer in installations where a 90° change of direction is combined with a change in pipe size. In addition to saving erection time and the necessity of an extra weld, this new Ladish reducing ell adds to the flow efficiency of the piping system.

Du Pont Chemicals

DuPont products are used by the petroleum industry in its every phase from exploration to refining. This is the theme of the DuPont exhibit at the Exposition. Of primary interest are DuPont tetraethyl lead compounds and other gasoline and lube oil addities. In many instances animated displays dramatize the uses and advantages of these products, among which are antioxidants, oil soluble colors, "Ortholeum" lubricating assistants and fuel oil stabilizers.

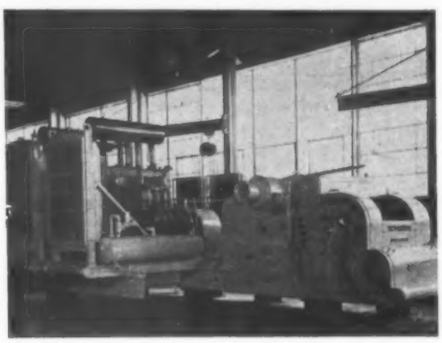
A new and safer explosive for shooting oil and gas wells is featured, along with DuPont "Nitramon" blasting agents and other products for seismic shooting. Also included in the display are products made of neoprene used in all phases of the petroleum industry from drilling and refining to distribution of oil and oil derivatives. The resistance of neoprene products to oxidation, weathering, oils and solvents, high and low temperatures and abrasion is illustrated.

Truck Mounted Drill

A new truck-mounted rotary drill is being shown by Engineering Laboratories, Inc., of Tulsa, which incorporates several new features. The M-7 was designed for water well drilling and medium-depth exploratory work. It includes use of an automatic power pull-down, which is effective over the full length of the 25-foot kelly without regripping or chucking. Specially designed drawworks and mast enable the unit safetly to handle loads up to 40,000 pounds. The power full-down supplies desired weight on bit automatically, and this weight is maintained, regardless of drilling speed or formations encountered. The shift from automatic to manual pull-down is accomplished merely by the flip of an ordinary toggle switch. The power take-off is made for a straight-through drive on a shaft to the drill. Power for the axle is secondary and is delivered through the power take-off through gears. All the controls are concentrated just to the left of the eight-inch rotary table. Driller can control raising and lowering of the mast, operation of the Wheatley mud pump, the drawworks, catheads, engine speed, power pull-down and its weight adjustment, as well as the operation of the drill from his one station.

Remote Gas Analyzes

Mine Safety Appliances Co. is showing its combustible gas analyzer with eight-way sampling valve which draws continuous samples from potentially dangerous locations and automatically tests them at a central location. When a pre-determined hazardous concentration is reached, an alarm signals visibly and audibly on a panel at the control location. It is intended principally for installation in refineries and high volatile tank farms.



Drilling Rigs

Bethlehem Supply Company has constructed an actual, fully-stocked field store on the ground and is exhibiting two completely new and different drilling rigs, the Tornado and the Whirlwind. A few of the outstanding features common to both rigs are self adjusting air friction clutches, all controls unitized at the driller's position, heavy duty streamlined frame, oversized brakes and balanced drums, roller bearings throughout and alloy steel shafts. The Tornado is Bethlehem's newest heavy-duty power rig. It is generally arranged for compounding three 300-400 HP gas or diesel engines and driving one or two pumps. Maximum flexibility is attained by the all-friction clutch drives, both in the drawworks and the rotating elements. Minimum space and short shaft bearing centers are required by use of a dual input drive to the drawworks from the compounding elements.

In conjunction with the Tornado is the giant new G-600 7¾ x 18 slush pump, and the G-450 7¼ x 16 duplex pump fills the last step in the range from 150 HP to 600 HP. The Tornado rig also includes the Bethlehem B-21-S heavy duty, oil bath rotary table; the A-350 roller bearing, streamlined crown and traveling blocks; and the 300-T swivel featuring a full armored stem, reversible wash pipe with double life and streamlined body.

The Whirlwind, rated for 7,500-foot drilling, utilizes torque converters in the compounding elements. These converters provide the features of steam power in hoisting and rotary table drive such as maximum flexibility, uninterrupted acceleration and shockless

stallproof transmission of power. A straight mechanical drive is provided to the pump to eliminate the danger of torque buildup. In addition to the oversize mechanical brakes, a hydrotarder hydraulic brake is built into the unit actuated by an automatic clutch. Every effort has been made to cut down rig-up and tear-down time. A Zephyr servicing hoist and coring reel is used in connection with the Tornado as a coring reel. This hoist uses a torque converter drive actuated by air clutches. It spools 15,000 feet of 1/16-inch cable. Included in the machinery exhibit are typical examples of Bethlehem's API line of pumping units.

Portable Drilling Equipment

Portable drilling equipment is being shown in operation under simulated field conditions by George E. Failing Supply Co. The three new post-war units displayed are: the Failing 750 seismo holemaster drill, the Failing "1500" holemaster drill and the Failing holemaster "2500" drill.

Pneumatic Reverse Clutches

Emsco direct air-operated reverse clutches displayed by Continental Supply Co. were designed to insure smooth transmission of power between internal combusion engines and drawworks originally sold to be steam engine driven. The clutches were designed because there are a great many efficient steam drawworks in the field today whose conversion would adapt them to a wider field of operation. They transmit the full power of the engines without grabbing or chattering and are flexible in operation. They incorporate a differential reverse gear which is instantaneous in operation and works in an identical manner to a steam throttle. All are equipped with an automatic neutral brake for positive control. A variety of single and double-driving sprockets are available.

125 Ton Connectors

The new series 125 Web Wilson connectors being shown have been designed to eliminate all load-carrying threads. In place of the threads a shear ring has been incorporated in the main shank. The heat treated, alloy steel shear ring gives great strength and simplifies assembly and disassembly in the event that repairs are ever required. The length of connectors is calculated to allow maximul working room in the derrick or mast and are designed for direct connection to the bottom of most makes of traveling blocks. A device operatble from the derrick floor locks the connection in any of eight different positions. The plunger and the bearing operate in a full oil bath assuring lubrication of the bearing and a controlled, hydraulic cushioning action for the spring. This feature prevents the drill pipe from bouncing when breaking-out and greatly increases the life of threads and tool joints.

Pipe Leak Clamps

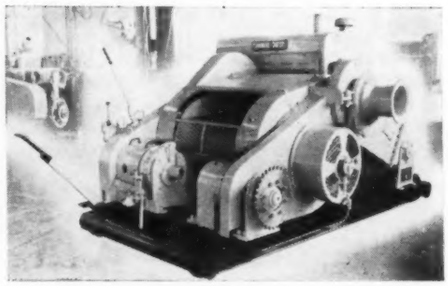
Marman Products Co. is showing several new types of pipe leak clamps designed for specialized application. The Patchmaster is designed to stop leaks on low or high pressure pipe ranging in size from one-half to four inches in diameter. It consists of a corrosion-resistant, stainless steel clamp and a specially designed patch plate of stainless steel annealed sheet, backed with a Hycar oil-resistant pad. Patchmasters have been tested at 800 pounds per square inch without leaking.

Short Connector

The pump division, oil tool division and Patterson-Ballagh division of Byron Jackson Co. all are exhibiting miniature and full-sze oil industiry equipment. The oil tool division is displaying some nine new pipe handling oil well tools including: (1) Speed Trip power slips, air-operated power slips controlled by the driller (2) the Powair tubing tong designed for production and workover crews; this power tool will handle all API tubing and light drill pipe to 3½ inches (3) the Powair combination spinning and make-up tong for casing and drill pipe from 3½ to 10¾ inches (4) various types of BJ elevators including a new development, the 75-ton center latch slip casing elevator for 8° external upset integral joint casing (5) the Super-Triplex line of hooks are exhibited in a cutaway unit (6) the BJ short upper eye weldless link, the latest development in a long series of BJ links (7) the new 475 Stubby connector with only 22¾-inch working length but with full six-inch of spring travel (8) two types of kelly bushings, one with wiper and another wtih two wipers that has a grease-packed area between the upper and lower wipers (9) included in the instruments on exhibit is the BJ portable weight indicator.

Phantom Pumper

An electrically operated remote well and tank control system recently developed by Black, Sivalls and Bryson is a feature of that company's exhibit. Use of the system reduces automobile and walking time for pumpers and switchers on large scattered leases. The system permits the pumper to perform the following activities from a central station without going out on the lease: (1) Selectively open and close any one tank in a battery of tanks (2) Selectively open or shut any one or all wells supplying oil to a chosen tank (3) Discern which tank is receiving oil at any time (4) Read the number of barrels of oil delivered to date on the chosen tank (5) Keep record of total production into a battery of tanks (6) Discern liquid level in each tank (7) Automatic "topping out" of tanks at preselected level.



Light Rotary Rig

Unit Rig Company's new model U-34 pictured here was designed as a light, dependable rotary rig which could be operated profitably on a small investment basis. The new U-34 has the same engineering and workmanship that goes into the U-15, and the resultant package reduces rig-up, tear-down and transportation time to a minimum. Unit Rig's new U-34 is conservatively rated from 3,000 to 3,500 feet with a 4½-inch drill pipe with the optional hydromatic brake, using engines of approximately 150 HP.

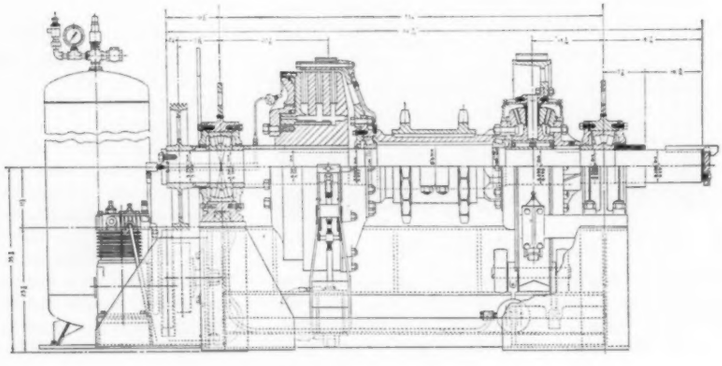
Kerosphere Valve

Kerotest Manufacturing Co. has a complete display of valves, including full flow pipeline gate valves, redesigned lubricated flow line valves, a new line of stainless steel valves and the exclusive new patened Kerosphere ball valve. The new Kerosphere needs no lubrication, requires only a quarter turn in operating and assures ease of operation at all times regardless of pressure.

Centrifugal Pump

Mission Manufacturing Co. is showing a new centrifugal pump which operates on the Sherzer hydraulic principle. The outstanding feature of this pump is the concentric casing which minimizes excess turbulence and cavitation normally caused by cut water in the conventional design. This reduces wear and results in sustained high capacity for the pump. The pump is of the single stage, end-suction type with non-clogging fluid passages. It can easily handle slurries containing large solids and materials in suspension. The casing, impeller and wear plate which come in contact with the fluid pumped are available in various types of corrosion-resistant alloys.

Another new addition to the line is the Mission power slip. These feature the "rolling dog" slips to which Mission has attached a simple and strong lifting ring



Emsco direct air operated reverse clutch.

connected to a power cylinder. Raising and lowering this ring by foot-operated control valve sets and releases the slips. The lifting ring with its slips can be easily and quickly swung into place and stowed away by one man. Two swinging joints enable the assembly to be swung completely out of the way of normal drilling operations.

Foxboro Instruments

The Foxboro Company, Forboro, Mass., is displaying in three sections the newest developments in instrumentation for the petroleum industry, the three sections covering production, pipeline operation and refining. Actual instruments in simulated operation as well as diagrams, installation photos and bulletins show the wide application. Features of the production section are: the dew point recorder for direct measurement of humidity; and the gas-powered integrating flow meter, a recent development which provides an integrating meter which does not require electricity to operate the counter.

Pipeline operators are being shown the auto-selector controller for controlling either the discharge or suction of a pump, with this selection automatically made in accordance with supply and demand requirements.

In the refining section a large flow-sheet of a modern refinery highlights some of the many applications of control instruments. The Model 40 controller, one of the most widely used Foxboro instruments in pertoleum refining, is shown. The new D/P cell (differential pressure) is seen in use with a recorder This new primary device has provided a solution to numerous troublesome metering problems, especially in corrosive service or where a meter with small displacement is required, or the use of mercury is undesirable.

Crown and Traveling Block Bearing

Aetna Ball and Roller Bearing Co. is showing new custom-built, heavy-duty bearings for oil country equipment. The new bearing is described as a combination ball thrust and radial roller crown and traveling block bearing. While subjected primarily to radial loads, crown and traveling blocks must also take secondary, yet pronounced, thrust loads which are constantly generated by the angular pull of the working cables. These thrust loads tend to lock and pinch the components of ordinary crown block bearings, thus causing undue friction, wear and early bearing friction.

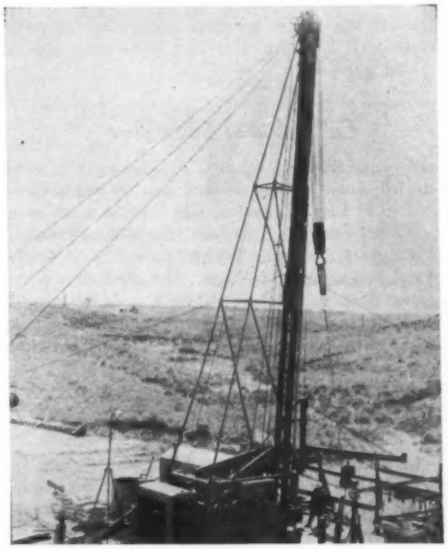
The new Aetna bearing is said to overcome this common fault by an ingenious design whereby the imposed loads are divorced from each other into pure thrust and pure radial. This is accomplished by the incorporation of a ball thrust bearing between each pair of radial roller bearings, the outer rings of which are made to act as dual-purpose races, serving as paths for both balls and rollers. The unit literally is, therefore, a two-in-one bearing of design compactness that makes for narrower and lighter, yet stronger, longer-life crown and traveling blocks. Increased radial load capacity is attributed to the basic design which frees the bearing's radial capacity of all former thrust load burden.

Welding Fittings

Both hand tools and Weldolet fittings are displayed in the booth of Bonney Forge & Tool Works. Wherever branch pipe outlets are taken off, or wherever thermometers or other meters are required, Weldolet fittings result in a material saving in finished-job casts. This is due to the fact that the use of these fittings eliminates all forming, fitting, beveling and aligning and results in a neat uniform appearance.

Stuffingboxless Pump

Reda Pump Co., in addition to the regular line of deepwell centrifugal pumping equipment, is displaying its stuffingboxless pump and its waterwell pump. The stuffingboxless pumping unit is designed to handle LPG in refinery operations, transfer and loading docks, liquid gas bottling plants, and for pipeline service of liquefied gases and liquids. A multistage centrifugal pump is close coupled to an induction motor and set into a steel tank which is equipped with suction and discharge ports. When connected to piping the unit becomes part of closed system. Motor and pump are easily removed for service without disturbing piping. NPSH requirements reduced to substantially zero feet at inlet, suction pressures practically unlimited, differential heads from 5 to 12,000 feet, and capacities from 3 G.P.M. to 1000 G.P.M. Visual lubrication indicators facilitate maintenance.



Spudders

Two machines from the Bucyrus-Erie spudder line are on display. The 36-L can drill top-to-bottom to a depth of 3,500 feet and handle a maximum tool weight of 4,200 pounds. It can service wells to a depth of 4,000 feet. The 48-L has a maximum top-to-bottom drilling range of 6,000 feet and can handle 6,000 pounds of tools. It handles well-servicing work to 7,000 feet. Both machines are available with gasoline, natural gas or diesel power.

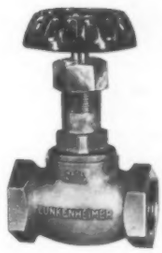
High mobility is featured in the design because of single-unit construction and high-speed mountings—tapered skid type base for easy loading to oil-field trucks or dual pneumatic-tired semi-trailer mounting for fast towing. Quick rigging up is made possible with a telescoping derrick raised and extended by a worm-gear-driven power winch. Tubular braces unfold as a unit and are easy to set in place. It takes two men just a few hours to move either of these rigs into place and set up. Five units of Bucyrus-Erie graders and shovels equipped with International crawler tractors are shown for lease and drilling site work.

RemoteSet Instruments

The RemoteSet equipment featured in The Brown Instrument Company display includes a remote index setting device for use with pneumatic transmission systems. It is capable of setting the control index of a distant controller. Features of the device are speed of transmission and stability. The RemoteSet is available in both indicating and recording models. The recording model provides a record of controller operation at the control house, combines two related records on one chart, and provides a method for the remote setting of two control indices on related controllers at the unit.

A recent innovation being shown is the Air-o-Larm system, a pneumatically operated system used to operate an electric signaling or warning device at certain limiting pen positions. The electric switches are contained in an explosion-proof housing, thus enabling them to be mounted in a hazardous area so as to give an "on-the-spot" warning.

S. P. Bronze Valves



The Lunkenheimer Co. is exhibiting a group of S. P. Bronze globe, angle, gate and check valves in the Continental Supply Co. building. The first application of full cylindrical body sections to bronze gate valves is made in a new Lunkenheimer design to provide maximum resistance to distortion and assure that initial proportions and seat tightness are maintained. The various valves also employ Lunkenheimer patented alloy stem material which eliminates steam-thread failures.

Blowout Preventer Hose

In the Continental Supply Co. building New York Belting and Packing Co. is showing blowout preventer hose that can be installed by one man in half the time formerly required by an entire crew for cutting, fitting and installing steel pipe. It is especially designed for all pressure-operated blowout prevent units, master gate, flow-line valve and the preventer proper.

Couplings are factory applied for safety. There is no danger of hazardous air intake with blowout preventer hose. It absorbs destructive vibration that occurs where a rigid line of pipe only is used. A synthetic rubber tube and cover and carcass of braided plies of high tensile steel wire are used to provide ample factor of safety for handling any pressure encountered in the operation of blowout preventer equipment.

Flow Instruments

Taylor Instrument Companies exhibit centers around its flow line of instruments, including aneroid and mercurial manometers, transmitters and receiving controllers. One section of the exhibit is devoted to a demonstration of the new Taylor integrator.

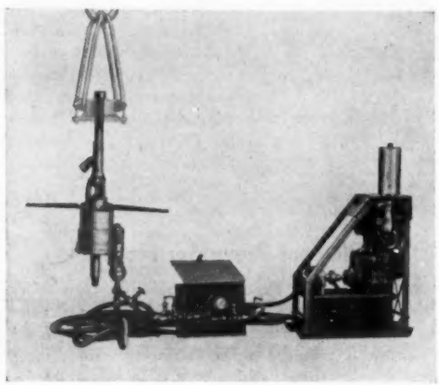
Since 1940 Taylor has greatly expanded its line of flow instruments and for that reason its exhibit is built around the flow line. Aneroid manometers with ranges of 1500 pounds and 300 pounds are on exhibit as well as the new stainless steel model. A new transmitter was recently announced, factory calibrated to accuracies to within one-half of one per cent of scale range. Extreme linearity of action is assured since construction of the simple single-bellows transmitting mechanism is identical with that of the receiver mechanism. Adjustments are easily made. This instrument is in operation at the show.

Portable Rig

Cardwell Manufacturing Co. completed its new Trailerig just ahead of the show. It is a complete drawworks built into a special trailer frame on top of which is mounted a 90-foot telescoping mast. The machine is so designed that the trailer frame also serves as the frame for the drawworks. This makes it possible to provide the trailer and drawworks and the mast in one unit with an overall height of less than 14 feet. The machine is only eight feet wide and 59 feet three inches long. The Trailerig is recommended for 5,000-foot drilling with 4½-inch drill pipe or workover jobs to 10,000 feet.

Speed Increasing Units

Farrell-Birmingham Co., Inc., is showing a series of newly designed speed increasing units with a ratio range of 1:1 to 12:1 with one pair of continuous tooth herringbone gears. Units having two sets of gears have a ratio range from 12:1 to 40:1. The lube-oil system has been improved and simplified with just enough exterior piping to make it easily accessible. It sprays a constant stream of clean, cool oil into the mesh line of the gears and pressure-lubricates the bearings.



Hydraulic Swivel

Baash-Ross Tool Co. is showing a recently-developed power swivel which is revolutionizing many light rotating jobs on modern oil-field operations. This unit features a hydraulically driven swivel which is operated by fluid under pressure which is generated in an engine-driven power unit which may be placed at any convenient location either on the rig or outside of it. Connection between the power unit and swivel unit is provided by flexible hoses which pass through a control unit in which all control operations are conveniently centralized. By means of a single control the swivel can be started, stopped and the direction of rotation reversed if desired.

The Baash-Ross power swivel is available in two models—one in which both the speed and the torque are constant and the other which features variable speed and variable torque. Because it requires no rotary table, no drawwork or other heavy equipment, it is used in light rotary operations where only a limited amount of torque is required. Both units develop a maximum torque of 15,000 inch-pounds, which is ample for such applications as drilling out cement plugs and sand bridges, for scraping paraffin, for rotating the run-in string on internal cutting jobs and other similar applications.

Motors

The Louis Allis Co. is exhibiting explosion-proof motors, splashproof motors, open dripproof protected motors and the Ajusto-Spede, a variable speed AC-drive motor. The latter is a device for transmitting controllable torque through the use of electro-magnetic forces in which there is no mechanical contact between driving and driven members. This device is especially suited for driving variable speed machines requiring a constant torque input throughout their operating speed range. The Ajusto-Spede has been used successfully on many drives where the requirement was smooth, constant acceleration. An eddy current brake can be incorporated when quick, smooth stopping is desired.

Animated Display

The exhibit of the Lane-Wells Co. is housed in a special modern-design building. On the apron are two service trucks, incorporating new developments in gun perforating and radioactivity well logging service. Inside are photo-murals and slide films to help display packers and formation testing tools, soon to be made available in all territories. An animated display demonstrates the operation of Lane-Wells radioactivity well logging instruments. The display of gun perforators includes the new 128-shot D-1 gun and the much-discussed Koneshot gun. Here again a continuous story in slide-film gives the salient information on Lone-Wells gun perforating service and its applications to different down-hole conditions.

Oil and Gas Separator

Climax Engineering Company is exhibiting a 2 x 11-foot, 500-pound Climax oil and gas separator, complete with internal torsion tube displacement type liquid level control. This level controller eliminates a stuffingbox, thus removing the possibility of freezing and packing gland leakage. Also shown are pilot-operated pressure reducing and back pressure regulators, diaphragm control valves, all float type continuous drainers, pressure balanced diaphragm control valves and regulators.

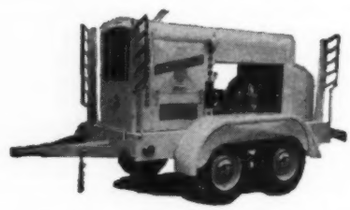
Core Drill Rig

Joy Manufacturing Co. is displaying two completely new motorized drill rigs designed for exploratory drilling, core drilling, electrical logging, seismograph and slim-hole production. Of interest to pipeline contractors and the refinery industry, Joy is showing rock drills, spaders, wagon drills, trench diggers, portable air compressors, hoists and winches, sheaves, portable blowers and the new series 1000 Axivane fans.

Advanced Seismic Filter

Geotronic Laboratories, Inc., of Dallas, Texas, has recently announced the development of a new electronic filter for use in seismic exploration equipment. The filter, type K-2, is available for installation in existing or new designs or may be had as standard equipment in the Geotronic series 4100 amplifier. Typical amplitude response characteristics are shown in the curves illustrated.

The filter comes in two units, a high cut and a low cut. For operation purposes, high and low-cut positions may be selected independently, and five of each are nominally available. The two sections may be used in tandem or in separate stages. The components are held to a one percent tolerance so that reproduction from one filter to the next is much closer than the smallest difference noticeable on the usual seismic record. One of the principal features of this filter is the attainment in practice of infinite attenuation at desired points other than at the zero or infinite frequency extremes. This is done despite the limitation on inductance Q attainable at subsonic frequencies.



Centrifugal Pumping Units

Stewart & Stevenson Services, Inc., has developed a centrifugal pumping unit which is enclosed and trailer mounted to meet the varying needs of the drilling, producing, and pipe line divisions of the petroleum industry. This unit can be attached to the rear of the lease car or truck and taken to any point where water, waste oil or drilling mud need to be moved. No priming is required yet much higher pressures are available than with ordinary self-priming pumps. Provisions have been made for carrying light weight piep and hose connections on the side of the unit so that rapid connections may be made between two points several hundred feet apart. This unit can also be adapted to fire fighting equipment.

Hydraulic Torque Converters

Twin Disc Clutch Company is showing sectionalized version of the Twin Disc air-actuated clutch, Model B power take-off and a small hydraulic coupling. In addition to the sectioned units the exhibit contains the hydraulic torque converter, Model CL heavy-duty clutch, and an exploded view of a large hydraulic coupling.

Hydraulic troque converters have been used with special-purpose pumps used for cleaning, standard cementing operations, squeeze cementing, slush pumps, cable tool rigs, direct-connected rotary tables and with hoists ranging in size from well-servicing machines powered by single engines to moderate-depth and deep draw works installations using multiple engines.

Casing Centralizer

A completely new design casing centralizer which provides 10-point contact and greater peripheral bearing on the well of the hole is displayed by Larkin Packer Co., Inc. The 10-staves in the Larkin centralizer work as a unit to provide a centering strength four times as great as a long staved centralizer similarly constructed. Due to the shorter arc of the stave, each stave has twice the strength as weuld the old long stave type. It has potentially 20 times the centering strength of a long staved centralizer that work as individual units, according to the manufacturer.

DEVELOPMENT OF THE OIL EQUIPMENT INDUSTRY IN THE UNITED KINGDOM

Contributed by the Council of British Manufacturers of Petroleum Equipment

FIGURES compiled and published by the Oil Companies Secretariat in London show that orders placed for materials and equipment manufactured in the United Kingdom for shipment to the British petroleum industry overseas during 1947 amounted to the impressive total of £46,777,000, an increase of £13,240,000 over 1946. The stature to which the industry has grown is thus revealed in the clearest possible way.

The growth of the industry in Great Britain is not entirely a postwar development but has been, of course, accelerated by the dollar position of the country which has forced a diversion from the prewar supply markets of the United States to the United Kingdom. The energy and ingenuity which British industrialists have brought to bear on the many difficult problems involved in the development of the industry need no emphasis.

By common consent the natural home of the oil equipment industry is in the United States of America. It was there that the modern oil industry began and experienced the phenomenal growth of which the whole world is so well aware. Equipment design kept pace with the industry, and the results of these years of trial and error and ultimate triumph over difficulties are now available to British industry.

This is not to say that the manufacture of oil equipment is exclusively a postwar development in the United Kingdom. Some of the large engineering firms have been associated with oil for many years, and on the refinery side it is a long time since Great Britain became self-sufficient as regards equipment. The Venezuelan refinery at Cardon is being built almost entirely with British equipment, and in the early days of the industry British engineers had much to do with developments in Scotland, Romania, Russia, etc. Even so, much help was being obtained from American design.

The manufacture of pressure vessels and fractionating towers has been a very important feature of the development of British equipment now available for reconstruction of refineries. A large development has also taken place in the manufacture of oil valves, the standardization of which, in line with American-made valves, is complete and interchangeability is thus insured.

On the drilling and production side Great Britain was for many years a good way behind the United States, and it is in this direction that the most extensive developments have taken and are taking place in the country since the end of the war.

An interesting pointer to the growth of the equipment industry is to be found in the record of the Council of British Manufacturers of Petroleum Equipment. The council was formed during the war with a nucleus of some half dozen companies engaged in the oil equipment industry. In six years membership has increase to almost 300 representing a powerful cross section of British industry. Last year the council issued its first composite catalog of oil equipment under the title of "British Petroleum Equipment" and January, 1948, saw the launching of a quarterly magazine, "British Petroleum Equipment News," to be devoted entirely to the equipment side of the industry. These publications represent a stable and permanent industry in the life of the United Kingdom. The council is beginning the appointment of local representation in various parts of the world, and visits by council members to a number of oil fields have been carried out with satisfactory results. Regional committees up and down the country, organized by local members for discussion and to acquaint industry generally with the importance of oil equipment, are in being, and exhibitions in important manufacturing centers are taking place.

The council is very much alive to the developments taking place in the United States of America, and not only carries out the duties of bringing British manufacturers more closely in touch with the actualities of the oil industry but also keeps the members up-to-date with these important developments in design and manufacture. It should be mentioned that even with a membership of almost 300, the council does not represent the whole of British industry engaged in the manufacture of oil equipment for production and refinery.

If British and American industry are to collaborate in the manufacture of equipment, as is the desire of British manufacturers, it follows that both countries should manufacture to identical standards wherever practicable. American standards, assessed over the years, have been decided under actual working conditions and so constitute the correct basis upon which to work. In preparing British standards—and work on this is going on constantly—this fact is borne consistently in mind, and when standards are established, they safeguard the interchangeability of British and American equipment.

Reverting to the extension of the manufacture of drilling and production equipment during the past year, much effective work has been done. Drilling of exploration wells and pumping of crude oil discovered in the British Isles has been carried out almost entirely with British equipment, aided in part by American knowledge and licenses. For the extended production of drill collars and Kellys, facilities to manufacture were granted by the Royal Ordnance Factories, thus short-circuiting an extremely lengthy program of factory equipping which would have been necessary in the normal course of events. The result is that these important items of equipment are now showing substantial production figures and are already in service in various parts of the world.

A good beginning has been made in the manufacture of rock bits in the United Kingdom. This was no easy undertaking, but the results now being achieved show that the effort was well forth while. Sample rock bits have been under rigorous test overseas, and the reports received on their performance are most satisfactory.

Development of slush pump manufacture is a further feature which should be mentioned in connection with 1947. This is a long-term program; types manufactured and sent for service during the year under review will be succeeded at a later date by further types.

British-manufactured pumping units are familiar throughout the whole of the oil equipment industry. The demand, however, is so voracious that substantial extensions in this field of activity continue unceasingly.

Items of equipment which may be included under the title of development program are high-pressure casingheads and pumping jacks, both entirely new to manufacturers of British equipment. It is understood that both these items will be in production in the near future.

Pipeline construction in the Middle East, following the example of the first Iraq line, is now being dealt with by British manufacturers. Pumping equipment and pipe has been entirely British to the design of British engineers.

Heavy electrical plant continues to be, as always, a major feature of British industry, and the same applies equally to steam-raising plant.

With regard to subsidiary drilling equipment, a program has been prepared to give attention to the manufacture of the very specialized tools used in the drilling of wells.

A contribution such as this would not be complete without mention of a sphere of manufacturing interest which is prominently British. The building of tankers has never been so active as at the present time. British shipyards have in hand a great tonnage program for both large and small tankers, not only for British firms but for overseas buyers as well. From the beginning this has been a main British industry, and the performance of British-built tankers has always been first class.

A feature of the past year's record of the British oil equipment industry has been the granting of a succession of licenses to manufacture in Great Britain items of American equipment. Two items that come to mind are special bubble caps and certain refinery process pumps. In the case of the former, the granting of the license means that super-fractionating, using corrosion-resistant steel, is now an accomplished fact. This question of licenses is very important and should be mutually advantageous to American and British manufacturers alike.

This brief recapitulation of the developments of the oil equipment industry in this country, the priority which is being granted to it by a large section of British industry, the great effort which is so obviously being concentrated upon it, all indicate not only the desire but the practical qualifications to collaborate with American manufacturers in this specialized field.

Altogether the industry can look back upon the past year with considerable satisfaction. In spite of many difficulties it may be claimed that a good start has been made and that the industry is forming into a coherent whole. There are still gaps in the list of equipment called for by oil companies and not yet manufactured in Great Britain, but they become fewer and fewer. The scope for development becomes even greater with the passing of time, as the volume of equipment being supplied to the oil companies is so infinitely less than their demands. It is confidently anticipated that 1948 will see an even greater expansion than 1947.

Decca Navigator Survey System

The Decca Navigator system is a radio device developed by Decca Navigator Co., London, in which three or four simple ground transmitters radiate at a very low frequency and provide a hyperbolic space pattern for highly accurate position fixing. A receiver (using pre-set tuning) provides continuous information of its position in relation to the transmitting sites. The system is based on a phase comparison technique and possesses an extremely high inherent accuracy. The use of the low-frequently radiation results in complete coverage over land, sea and at all altitudes used by aircraft.

The Decca Navigator system has been developed very extensively as a navigational aid, and a variant of the original has been evolved for survey use. It is particularly advantageous for aerial and for hydrographic survey, although other developments are under way. By its use a very considerable speeding up of the operations may be achieved combined with the high standards of accuracy. This reduces the cost of aerial survey and makes possible hydrographic charting at a much greater rate than has been hitherto practicable. The Port of London Authority uses the Decca system for marine survey work. A survey chain for the Danish government has been erected for hydrographic work in Greenland, and the Swedish government has purchased a chain for hydrographic survey in the Baltic.

For aerial survey the Decca Navigator system has the advantage that it may be used for continuous navigation at all times, from the moment of take-off to landing, since one of its characteristics is that the altitude of the aircraft does not affect the radio reception of the pattern. The system is used for all the mapping and photographic operations.

Portable Foam Generators

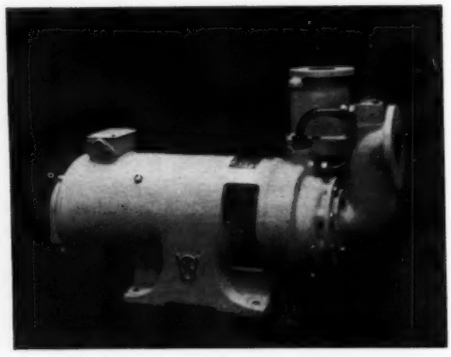
The great problem of dealing with fire dangers in oil storage tank depots is now effectively solved by the provision of the "Pyrene" mechanical foam generator manufactured by The Pyrene Co., Ltd., London. This new appliance provides the high rate of delivery of a viscous, stable foam essential for successful extinction of oil fires, yet the provision of extensive fixed pipelines is no longer necessary.

These generators are made in a range of three sizes delivering 380, 960 and 1800 gallons of foam per minute respectively. The smallest model may be operated with any existing fire pump having a water capacity of at least 56 gpm at 150 psi. This foam generator, which may be placed adjacent to the pump itself, passes foam through ordinary fire hose, the only fixed piping being the foam riser fitted to each tank. Operation of the unit is thus centralized and the foam compound induced at the water head of the generator or into the suction of the pump. Being in liquid form, the foam compound readily lends itself to movement in piped circuits.

The Pyrene Co. is specializing in the design and construction of self-contained foam tenders for oil tank storage. These vehicles are usually equipped with two 960 gpm mechanical foam generators, a tank containing 600 gallons of "Pyrene" foam-making compound, a fire pump of 350/600 gpm capacity with its own power unit and the required hose and foam nozzles. Where necessary CO_2 fire-fighting equipment is also fitted.

Welding Fittings

Seamless welding fittings are a new product of British manufacture now being produced by Munro and Miller, Ltd., London. Return bends and 45-degree and 90-degree elbows are being manufactured to both American and British standards in long and short radius styles. Sizes of these fittings and of steel piping offered by the company range from two to 16 inches in American standards and from two to 12 inches in British standards.



Self-Priming Centrifugal Pumps

The "Cevac" is a recently patented, self-priming centrifugal pump developed by Worthington-Simpson, Ltd., Newark-on-Trent, which is particularly suited to the handling of volatile liquids such as gasoline. Normally the pumps are manufactured with pump and motor combined as a single, balanced suit, but they can be supplied with a standard driving head for use with special motors or belt drive.

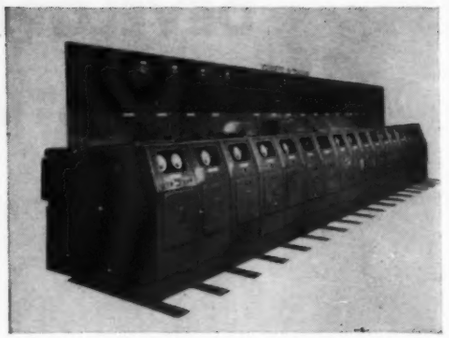
The "Cevac" embodies a combination of the vortex type vacuum pump with a normal centrifugal impeller simplified to the extent that the two impellers are cast in one piece and operate in the same chamber. There are no more working parts than in an ordinary non-priming pump, and th priming element does not interfere with the efficiency of the centrifugal impeller.

During the priming operation the vortex pump operates alone, extracting vapor or air from the suction pipe up to 24 or 27-inch vacuum. After priming the vortex handles the liquid being pumped and so operates as a liquid pump in parallel with the centrifugal.

Since there is no discharge of liquid or vapor to the atmosphere, the pump is ideally suited for handling volatile liquids. Vapor drawn from the suction line is discharged into the pressure line during priming. The unit gives a centrifugal pump characteristic curve, so there is no disadvantage in running on a closed discharge valve. No by-pass and relief valve system is required for close-valve operation.

Climate-Proof Switchgear

Yorkshire Switchgear & Engineering Co., Ltd., has developed a switchgear which has been tropicalized for use under adverse indoor or outdoor conditions. A climatic laboratory was built at Leeds to insure that this switchgear would withstand the extremes of climates for long periods. It is proof against the growth of fungus and bacteria, high humidity, dust,



metallic and salt-laden atmospheres, animal pests and mechanical stresses due to rapid temperature changes.

About half of the tropicalization process consists of the application of special finishes and other types of treatment, and half of the features of design. The former includes the wide use of non-ferrous metals—aluminum, brass, bronze, phosphor bronze, etc., are all utilized—and a number of special finishes. Steel is reduced to a minimum; in the case of certain bearings it is, of course unavoidable, in which case stainless steel is used; in other cases it is treated with two or three coats of non-ferrous metal spray and given a high-temperature vitrification treatment in addition. Electrolytic problems have been solved by the selection of suitable electroplating materials. All brass parts, although non-corrosive in themselves, are protectively coated to prevent the formation of verdigris. The influence of tropicalization technique on design is seen particularly in the construction of the coils. These, including the main solenoid coil, are completely protected by a bituminous plastic molding, and in the case of the smaller coils, silicone resin coil insulation is used to withstand the high temperatures applied in the molding operation. It was found in the testing chamber that laminated fibrous materials were in general unsuitable for tropical climates, and in all cases these have now been replaced by ceramics or plastics of the polythene group.

Already operating in tropical countries with satisfactory results, these new tropicalized circuit breakers are now being made at the rate of 100 units a month, and many are on order for oil refineries in South America and the East Indies.

The metal-clad units include a special feature for controlling the starting of large horsepower motors which are started direct-on-line, thus allowing for the very heavy starting current, but yet at the same time containing a protective feature, causing it to trip a 20 percent overload and so protect the motor.

Oil Field Trucks

Scammel Lorries are now manufacturing a further series of specialized vehicles for oil-field work, the main types being 16 or 18-foot, four wheelers and ten-foot wheelbase vehicles acting either as tractors or as motive units for semi-trailers.

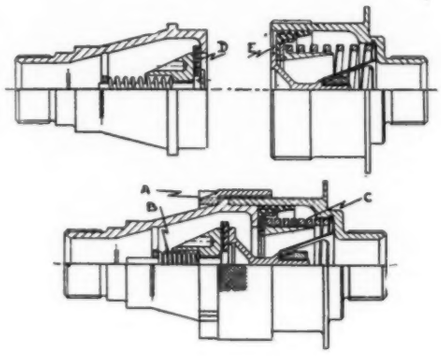
These vehicles incorporate the standard constant mesh

six-speed gearbox, fully floating epicyclic driving axle and Marles cam and double-roller type steering. Braking on all wheels is by air pressure system supplied by a Clayton compressor delivering 10 cubic feet per minute. Westinghouse two-lining couplings are provided for trailer brakes. The power unit is a Meadows six-cylinder diesel engine RAC rating 63 HP developing 128 BHP at 1900 rpm.

Special features include a tropical type radiator, all-metal cab with insulated roof and high discharge exhaust system. Both 16 and 18-foot four wheelers are provided with a split transmission type power drive for auxiliaries which are fitted between gearbox and driving axle, allowing all the gearbox ratios to be used for winching, etc. The 18-foot four wheeler is fitted with a steel-covered, hard wood body, with an eight-inch diameter loading roller at the rear.

Telescopic Taps

Phillips Telescopic Taps, Ltd., Birmingham, has developed a tap for internal application to shipping drums. Drums equipped with these taps may be shipped with no protruding element, thus protecting against damage or less in transit. On arrival the drum is ready for quick and clean withdrawal of contents merely by breaking a thin seal and pulling out the tap. Models are available which may be screwed into standard drum openings where detachable taps are required.



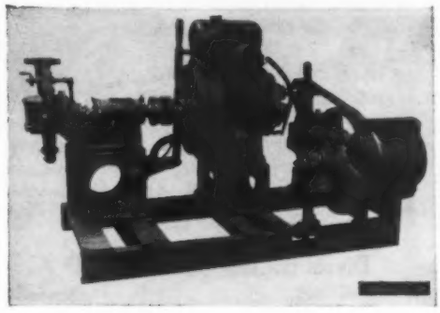
Self-Sealing Pipe Coupling

World patents now are pending on a self-sealing pipe coupling which, fitting in the line as a normal union connector, enables the joint to be broken without loss of contents or entry of air or dirt. Exactor Control Co., Ltd., London, the makers, are now offering couplings in sizes up to eight inches but will undertake sizes of 12 inches or larger. The couplings will remove risk in bulk handling of petroleum products or dangerous chemicals, particularly in the filling or emptying of tankers, interconnecting blending tanks or bunkering. Necessity for draining lines before disconnecting is eliminated.

In effect this coupling combines in one mechanism a pair of automatic valves which, as the joint is uncoupled, seal off the line on both sides. By reference to the diagram it will be seen that as the outer ring A is unscrewed, the two springs B and C extend and combine to press the two halves of the coupling apart. Thus the fluid path is gradually narrowed until the rubber valve faces D and E rest simultaneously on their sealings and are firmly held there by pressure of the springs. Another few turns of ring A disengages the two halves of the coupling, each then presenting a closed end. When re-making the joint the two halves of the coupling are brought together and ring A engaged with its corresponding thread. As the ring is screwed home, the valves are progressively opened against their spring until full bore flow is reestablished.

During the experimental work particular attention was paid to the maintenance of a smooth, unconstricted flow path wtih minimum change of direction when coupled, and to the provision of a clean breaking action free from dripping, and the avoidance of air inclusion on reconnection.

Pipeline Test Pump



A portable gasoline-engine-driven water pump recently was built by Joseph Evans & Sons, Ltd., Wolverhampton, for pipeline testing by Burmah Oil Co. The pump is being used to test units of ten-inch pipe about a mile in length.

As shown in the illustration, two pumps are mounted on the unit. A single-stage centrifugal with a capacity of 50 gpm at 70-foot head was provided for filling the line. For test purposes a 1 1/16 by 3-inch horizontal treble ram pump is provided. This pump delivers two gallons per minute against a maximum pressure of 800 psi. at a crank speed of 200 rpm. Pressure gauge and relief valves are provided.

The motor used to drive the pumps is a three horsepower, 1500 rpm Petter fitted with clutch for direct coupling to the centrifugal pump and by V-rope drive and clutch to the pressure pump. The entire unit is mounted on a steel baseplate and weighs 800 pounds.

Thread Grinders

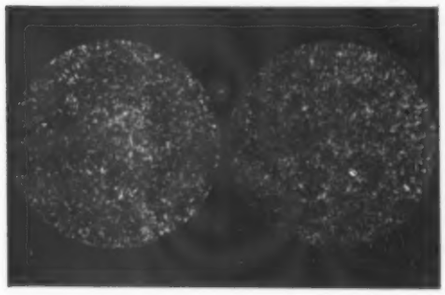
Coventry Gauge and Tool Co., Ltd., Coventry, now is producing two models of thread grinders which make possible the manufacture of accurate hardened screw gauges, taps, dies and hobs in oil company machine shops. Before the development of thread grinding, the best available method of making taps was to machine the thread on a lathe and afterwards to harden them, with consequent uncontrollable distortion of pitch, stranghtness and diameter. Similarly screw gauges were machined, then hardened, and afterwards lapped to what today would be regarded as merely an approximation of accuracy. The advent of thread grinding machines made it possible to harden the workpiece before grinding the threads, thus entirely eliminating the effects of distortion and, in the case of taps, hobs and other cutting tools, to produce cutting tools of infinitely greater accuracy at a higher rate of production.

The chief difference between the two Coventry machines lies in the length of workpieces they can accommodate. Th Type 39 is capable of grinding a thread up to nineteen inches long at one setting, while Type 46 can grind a thread up to 41 inches in length. Both are fully universal and capable of producing single or multi-start threads (either taper or parallel), to any desired form with any pitch up to 60 threads per inch. At the other end of the scale the machines will grind a lead up to 12 inches per revolution. Automatic relief grinding for taps, hobs, etc., is a feature of both machines, and internal threads can be produced by employing an internal attachment.

Drilling Equipment

The Oil Well Engineering Co., Stockport, has been engaged in the manufacture of oil-field producing equipment for the past 37 years and now is in the top one percent of British engineering companies in capital invested, number of workers and value of product. Its workshops now cover an area exceeding 280,000 square feet.

In addition to the manufacture of the National line of oil-field equipment as sponsored by the affiliated National Supply Co., Oil Well Engineering is making the following items under license: Lee C. Moore jackknife masts; Baker Oil Tools floating equipment; American Iron and Machine Works overshots; Chiksan steel rotary hose, circulating heads, swivels and mud guns; Parkersburg Rig and Reel hydromatic brakes; Byron Jackson (Patterson-Ballagh Division) rubber goods; and Baash-Ross Tool Company's roller kelly bushings and utility blocks. On its own account the company manufacturers blowout equipment, drilling and pumping derricks and allied equipment as well as a full line of rotary drilling equipment.

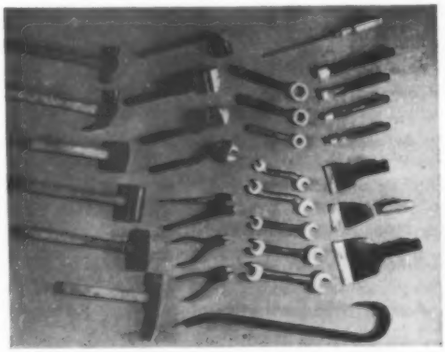


Microscopical examination of Newall Hi-Tem studs was carried out before and after tests at 450°C for three months. No evidence of any intercrystalline failure could be noted either in the body of the specimen or at the thread roots.

Newall Hi-Tem Bolts and Studs

The conditions imposed on bolt and stud fastenings, due to the advancement of technique in oil refining, have become increasingly arduous. It was to combat these conditions that Newall Hi-Tem bolts and studs were developed by A. P. Newall and Co., Ltd., Glasgow. They have excellent tensile properties at normal temperatures and, what is much more important, retain this advantage at elevated temperatures.

They also possess a high impact value. An examination of the microphotographs witnesses the considerable degree of resistance to embrittlement at elevated temperatures. The importance of heat treatment in parts used for such critical service will be readily realized. To guard against the possibility of error, all Newall Hi-Tem bolts and studs are treated in the most modern-automatically-controlled, electric furnaces.

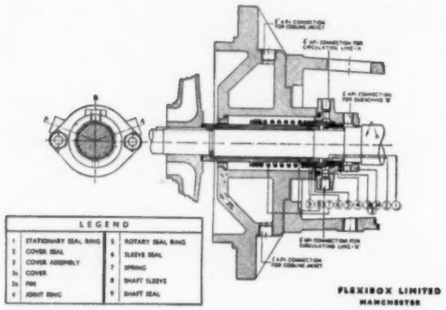


Non-Sparking Tools

Beryllium copper is being used by The Telegraph Construction and Maintenance Co., London, in the manufacture of non-sparking safety tools for the petroleum industry. The alloy as produced by Telegraph has a nominal composition of two percent beryllium, 0.25 percent cobalt and 97.75 percent copper. In this composition the metal shows great freedom from

sparking, and should small particles of the metal become incandescent owing to heavy abrasion from the body of the tool, the sparks have only a very short life. This is on account of the high thermal conductivity and non-pyrophoric nature of the alloy.

SEAL TYPE RR FOR OIL REFINING PROCESS PUMPS



Mechanical Seal for Oil Process Pumps

A new type of mechanical seal for oil refining process pumps is now being produced by Flexibox, Ltd., Trafford Park, Manchester, a member of the Manchester Oil Refinery group of companies. Known as Type RR this seal is the outcome of ten years design, development and manufacturing experience and embodies several outstanding features.

The seal fits inside the conventional stuffing box and, therefore, does not entail any alterations to the pump. A unique feature is the patented spring drive. The spring (7), made from stainless steel, is an interference fit on the thickened portion of the shaft sleeve (8) on one side and on the neck of the rotary seal ring (5) on the other side. In addition the sense of winding of the coils of this spring is such that, in operation, it tends further to increase its grip. Consequently the rotary seal ring (5) is driven positively yet resiliently and the static seal (6) is not subjected to any frictional wear. It has been found during prolonger tests with various designs of seals that erratic behavior is due in most cases to side thrust transmitted to the rotary seal ring by driving pegs, screws, tongues, etc. The spring drive incorporated in the RR seal is a solution to this problem.

Two tapped holes ("A") are provided in the cover (3A) and connected to the discharge and suction sides of the pump respectively, thus providing effective circulation of the pumped liquor around the two seal rings in order to remove frictional heat and, at the same time, prevent the accumulation of sediments, etc. A needle valve is arranged in one of the lines for controlling the amount of circulating liquor. This feature has proved extremely useful, and it prolongs the life of the seal considerably.

In the case of hot-oil pumps, the liquid coming from the discharge side is taken through a cooler before entering the connection ("A"), thus keeping the seal at a temperature which is safe for the synthetic rubber components employed. A quenching connection ("B") is provided for use if desired.

Automatic Exchange Coupling System

An automatic exhange coupling system has been developed by the Automatic Telephone and Electric Co., Ltd., Liverpool, for use in oil refineries, gasoline plants or other hazardous areas. The system has been approved by the Factories Department as being safe for use in pentane and provides for full automatic intercommunication between all parts of any petroleum plant. The same normal automatic telephone service can be provided to and from telephones in all hazardous locations as is given between telephones located in safe areas.

This system has also been certified by the British Ministry of Fuel and Power as being safe for use in methane and is already in use in many coal mines. Direct access is given from any automatic telephone on the surface to automatic telephones installed underground; also, by the addition of an automatic switching unit operating in conjunction with an existing certified magneto switchboard, automatic calls can be extended to or from any existing certified magneto telephone located in the danger zone.

It will thus be seen that in all plants handling petroleum products and in coal mines, in both of which inflammable gases constitute a hazard, an automatic telephone system can now be installed which, while providing a full service between all parts, whether classified as safe or hazardous, will insure complete safety to personnel and plant.

Diesel Engines for Oil Field

During the postwar years Davey, Paxman & Co., Ltd., Colchester, has handled orders for diesel engines for oil-field duties covering a widely spread number of oil fields in Peru, Venezuela, Trinidad, Iraq, Iran, Burma, Syria, Egypt, Bahamas, Papua, Ecuador and Assam. The Paxman range includes units to cover all phases of oil-field operation, including generator and pump drive. For drilling the Mark 6RPH six-cylinder model and the Mark 12RPH 12-cylinder model are of a light and compact design for mobility but capable of continuous operation under the most difficult conditions. The drilling set illustrated is designed and constructed as the power unit for drawworks and slush pumps and comprises a pair of Paxman 6RPH six-cylinder four-stroke cycle diesel engines, each having a continuous output of 200 BHP at 100 rpm.

These sets are self-contained, with radiator cooling and scoop-controlled hydraulic couplings, all mounted on fabricated steel skids. Clutches and V-belt compound drive equipment are provided, together with V-belt slush pump and roller chain drawworks drives. Remote control of the engines is by Teleflex equipment, the control center being in the driller's position on the drawworks, while hand regulation of speed works in conjunction with hydraulic relay governors in the engines. The 12-cylinder V-type engine for use in larger rigs has working parts interchangeable with the six-cylinder model.

Vertical Self-Priming Pump

British LaBour Pump Co., Ltd., London, has developed a new vertical, self-priming, packingless pump to add to the long line of self-priming centrifugals which the company has been building for nearly 25 years. The new Type G is said to mark a new milestone in pumping history, as did the first self-priming pump. Type G has no packing or mechanical seal. There

British Pressure Vessels

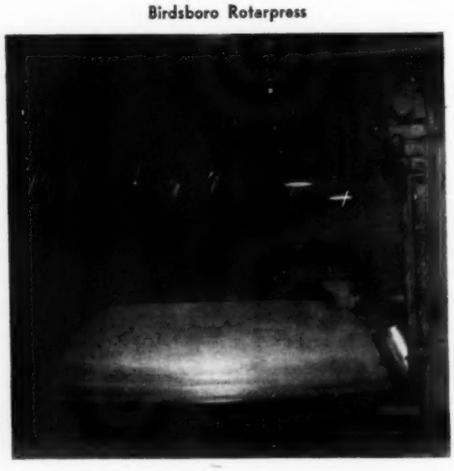
A new line of business in England is the manufacture of large pressure vessels for the oil industry by G. A. Harvey & Co., Ltd., London. The company began manufacturing pressure vessels some years ago, but it is only since the war that it has been turning out the very large API/ASME code vessles required in large modern refineries. At the moment Harvey is completing the fabrication of a 10- by 84-foot flash fractionating column made from two-inch plates and weighing 108 tons. The column is of Class I construction with all welds X-rayed and stress relieved. Gas-oil separators also are built.

A new departure in Britain is the production of semi-ellipitical heads by the spinning process. In Harvey's new 700-foot shop a Birdsboro Rotarpress, as shown in the accompanying photograph, has been installed. This machine will handle hot plates up to 17 feet in diameter and up to six inches in thickness.

Essentially this equipment consists of a central overhead hydraulic ram carrying a formed tool top which is free to revolve. Directly below this is a power-driven bottom tool. The hot plate is placed between the two tools and centered by four vertical rollers carried on large quadrant arms which can be screw-adjusted on floor slides to suit the work diameter. The photograph illustrates how the roll is brought to bear on the edge of the plate and manipulated to bend the material downward to the desired contour. The knuckle radius is produced later by a shaped saddle die. Full control of all movements is provided from a panel at the rear.

Harvey's huge new shop has been laid out for flow production. In the construction of vessels such as a recently-completed 150-foot 8-inch, 54-tray absorber, the following sequence will be possible without backward movement of the work: at the entrance end the edges of plates and dished ends will be cut, planed or machined in a lathe or borer and the plates then formed to shape on vertical rolls. Vessels then will be assembled by tack welding and moved to the Unionmelt fusion welding equipment for completion of main seams. The X-ray section for weld examination is adjacent. Further along in the shop various fittings are welded on, the stress relieving furnace is entered and, finally, the vessel is given a hydraulic test near the exit doors.

Birdsboro Rotarpress



Refinery column being built in Harvey shops.

is no rubbing action or close clearance so that the pump will never require replacement of packing or tightening of the gland.

The Type G pump has but one running part, the impeller with its integral hydraulic seal. The drive shaft enters the pump on the suction side, and the seal is thus required to work only against atmospheric pressure wtih a maximum pressure differential of 14.7 pounds per square inch. The seal is never subjected to and is unaffected by discharge pressures. The gland seal is actually maintained by the liquid being pumped. Self-priming is accomplished by hydraulically controlled recirculation of the liquid, and the pump is designed to utilize this hydraulic principle and will give a suction lift of 20 in. HG.

In operation air and liquid are trapped in the pump, discharged into an expansion chamber where the liquid falls back into the pump and the air dis dicharged. The pump will continue to discharge air until the suction line has been emptied which is approximately at the rate of two feet per second.

Gauging and Sampling Heads

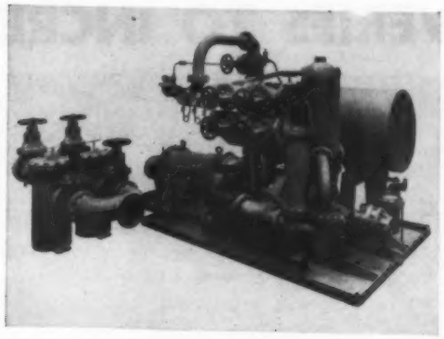
Watts Fincham (1932) Ltd., London, is manufacturing gauging heads, sampling and temperature-measuring heads and gas sluices for safe, gas-tight applications in the petroleum industry. The heads are mounted on tanks above fullway valves of adequate bore to accommodate thermometer, sampling bottles and measuring tapes.

The sampling and temperature-measuring head is illustrated. Two tapes are wound on storage drums in the head. One is calibrated for measurement and the second plain for handling of sample bottles. Tape calibrations may be read through the window which is equipped wtih a wiper arm and felt. When sampling is undertaken, the fullway valve is closed after the sample bottle is raised, the door of the sluice is opened, and the sample removed with virtually no gas loss.

Preformed Wire Rope

British Ropes, Ltd., Doncaster, England, is identifying its performed wire ropes with a blue strand to indicate that the product has the easy working and long-life qualities inherent in the preformed method of manufacture.

Ordinary wire rope is made by forcibly laying and holding a number of wires into a strand, the same process being applied in turn to the strands. The end of the rope then is seized to prevent untwisting The whole rope, is in effect, a loaded spring, full of internal stresses. In preformed construction the wires are preformed to the exact helical position they are to take in the finished rope. When preformed rope is cut, the ends do not fly apart but remain in their natural, relaxed position. Preformed rope has a longer life because of even distribution of wear and load. Kinking tendency is reduced and splicing is easier.

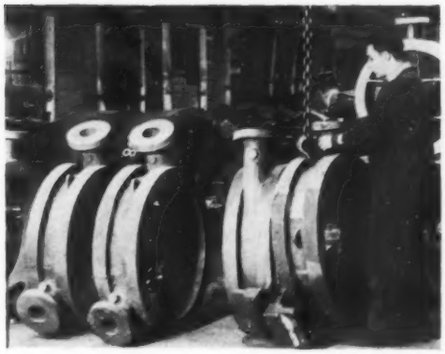


Industrial Oil Burner

One of the latest burner developments of The Wallsend Slipway & Engineering Co., Ltd., Wallsend-on-Tyne, is a low-air-pressure-regulated swirl type which can be applied to almost every kind of furnace in suitably modified design. The burner was evolved to obtain varying types of flame by employing a swirl regulator which gives a whirling motion to the air, causing it to spin in the nozzle of the burner. This spinning sets up a centrifugal action with the result that, on issuing from the nozzle of the burner, the mixture of oil spray and air spreads in a conical form.

The angle of the cone or spray or width of flame depends upon the amount of whirl given to the air. The length of flame is regulated by the lever on the body of the burner which is clearly marked "long" and "short."

The regulated swirl type of burner was specially designed for dealing with the heavier classes of fuel oil at present on the market, and efficient results have been obtained from tests carried out when burning fuel oils having viscosities of 200, 600 and 1,500 seconds.



Oil Equipment Castings

The David Brown Foundries Company's foundry at Huddersfield is specializing in the design and production of high-grade castings for use in petroleum equipment for outside manufacturing concerns. So successful has the Foundries Company been in this direction during the last three years that it is producing castings for every British firm of petroleum plant manufacturers. A fortnight ago the foundry was visited by the Argentinian and Venezuelan ambassadors, who said they were particularly interested in the potentialities of supply to Latin America to ease the present acute shortage.

Stationary Engine

Associated Equipment Co., Ltd., Southall, Middlesex, has redesigned its stationary oil engine with the particular object of making it suitable for service under onerous tropical conditions. Engines of this type are now flowing from the assembly line. Engine generating sets have been supplied to Iraq Petroleum Co. for operating oilfield welding plants in the Middle East, and a number are now being built for service with general purpose hoists in Venezuela. Ship auxiliary type engines are being supplied for pontoon drilling rigs and floating cranes, and marine engines are built for oil company inspection launches.

Latest unit in the A.E.C. line is the 9.6 liter six-cylinder, 100 bhp, 1,500 rpm model. This unit is equipped with a Ricardo head to provide greater torque at a higher speed range, to maintain a cleaner exhaust over a greater range than is possible with a direct-injection engine, and to permit the use of a wide range of fuel oils without engine modifications.

Impregnated Pressure Cable

Research and development work on the impregnated pressure cable in 1947 by British Insulated Callendar's Cables, Ltd., London, was directed to improving the engineering features involved in layout and installation work on cables for service voltage up to 132 KV and to increasing the established merits of the system.

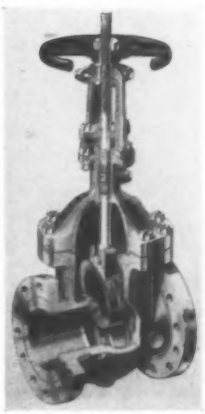
The alarm system now in use with these cables employs pressure-actuated switches embodied in each joint and a multi-channel pilot cable incorporated within the interstices of the main cable. Any undesirable drop in gas pressure due to mechanical damage or any other cause sends off a signal to the control plant, automatically giving the alarm and indicating the joint position nearest to the leak. In the majority of cases this alarm signal will be sufficient, but the technique of direct leak location by other methods has been built up for use where necessary. This is achieved by gas-flow determination employing air/nitrogen displacement methods in combination with differential flow detection by means of heaters.

Alloy Steels

Hadfields, Ltd., Sheffield, has installed rolling equipment for the production of both alloy and carbon steel in sizes used by the oil industry. The rolling plant comprises a 28-inch cogging and finishing mill designed for the reduction at one heat of 2,500-pound ingots to 2½-inch minimum billets. The mill is of the reversing type, electrically driven, and the actual housing carries the cogging and finishing stands, each with 28-inch diameter rolls. Floor equipment includes live rollers for conveying the ingot or bloom, manipulators for handling the ingot between passes and moving the bloom across to the finishing stand.

Auxiliary equipment includes hot saws, oxy-acetylene deseaming plant and ingot planing machines to secure a high degree of freedom from billet surface defects. Great attention is being given to maintenance of surface quality by provision for slow cooling and incorporation of grinding, shipping, torching, picking and magnetic crack detection. Hadfields also operates 11 and 14-inch mills.

Cast Steel Gate Valves



Glenfield and Kennedy, Ltd., Kilmarnock, Scotland, are manufacturing cast steel valves in all sizes for oil refinery and pipeline work. The principal parts are made of cast steel to comply with the specifications of the individual companies. The seats and operating screw are of stainless steel and the valve is designed for repacking the gland under pressure. The valve illustrated is a standard Series 300.

MEXICAN DISCOVERIES TO INCREASE PRODUCTION

Mexico City

EVER since the expropriation of foreign-owned oil properties, the tenth anniversary of which was celebrated here on March 18 last, rumors have been revived at frequent intervals that outside capital would be invited, or permitted, to share in the development of Mexican oil resources. Sometimes the story is that former concession holders will be allowed to resume operation of their holdings on some sort of a share basis with the government. Sometimes it is a report that individual operators or "independent" companies would receive concessions. Before the late war there were several alleged advances by European and Asiatic governments looking to participation in Mexico's oil industry.

This year was no exception. The flurry was set off by several unrelated incidents. One was the charge made by J. Edward Jones that the big international companies were trying to "throttle" Mexican oil development and that he was unable to carry out his drilling contract in Mexico because these interests prevented him from obtaining necessary materials. Another was the speech of Senator Chavez of New Mexico urging that the United States encourage oil production in Mexico rather than in the Middle East. A third, though it attracted less public attention, may have been the memorandum sent by the State Department in Washington to all Latin American governments calling attention to the world-wide shortage of available oil supplies, urging the desirability of action by each nation possessing undeveloped petroleum resources to bring these into use, and suggesting that the task required "the best petroleum technology, diversity of effort and access to large volumes of risk capital, all of which would be available fully and freely by calling upon the world petroleum industry."

In reference to the allegations of withholding materials for oil operations, Senator Burmudez, head of Pemex, said: "Petroleos Mexicanos has had difficulties in obtaining materials as have oil companies in the United States. Petroleos Mexicanos is not an exception in these difficulties, but we are confident that, thanks to the magnificent relations existing between the governments and the people of Mexico and the United States, we will certainly get the material necessary for drilling. We also hope that with the passing of time those difficulties will diminish and we can get greater amounts of materials, particularly drill pipe and casing."

There is no question that Mexico is anxious to increase oil production and to enlarge its exports. Senator Bermudez has stated many times that, while the first task is to provide for the demands of increasing domestic consumption, the officials of Pemex and of the government are looking to a resumption of the country's former large-scale exports. Extensive plans for the achievement of this aim have been drawn up. Likewise Mexico will welcome the assistance of outside skill and capital, but on its own terms. Concessions such as were held by foreign controlled companies prior to expropriation are out. They are specifically prohibited by Mexican law, and any attempt to change the law would be against public sentiment and would be bitterly fought by the labor unions.

An example of the kind of terms on which Mexico is willing to accept the cooperation of outside capital is afforded by the agreement just concluded between Pemex and Cities Service Company. At the time of expropriation ten years ago, subsidiaries of Cities Service Company held a concession in eastern Mexico, north of Tampico, covering 1,700 square miles, over a million acres. It will be remembered that the seizure by the government of foreign-owned properties resulted from a labor dispute. Since the development of this particular area had not begun, it, like a few other holdings, was not affected by the decree and the property, by agreement, has remained in statu quo since that time.

Negotiations over the matter have been proceeding for some time and have now resulted in the formation of Mexico-Cities Service Petroleum Corporation which will provide capital for exploration and development of the tract by Pertoleos Mexicanos. While other details of the agreement have not been made public, it is understood that any oil produced will be the property of Petroleos Mexicanos but that Cities Service Company will have the right to purchase a substantial portion of it on favorable terms and to recover exploration costs by this means. Apparentaly Cities Service officials feel, as a result of surveys already made, that the prospects of finding production are sufficiently good to justify the risk of capital in exploration.

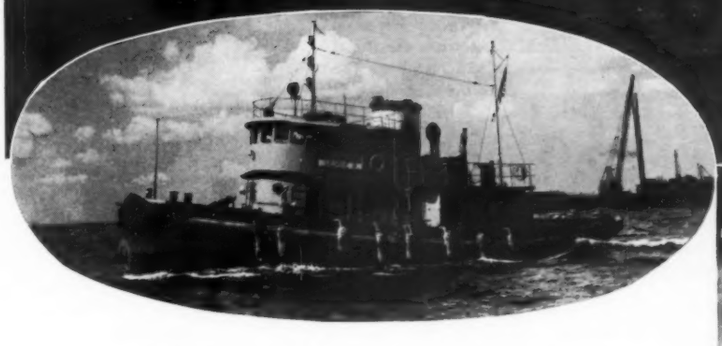
At the present time, however, geophysical crews and drillers from the United States are working on a contract basis for Pemex, and the company at various times has retained experts from north of the border to act as technical advisers. Phillips Petroleum Co. is negotiating with Pemex for an operating agreement and Glenn McCarthy, Houston independent, is reported working on a drilling deal. Other proposals along similar lines are rumored from time to time and may receive consideration if substantially backed.

Meanwhile the Mexican industry with its present organization and forces is making encouraging progress according to the report rendered by Senator Bermudez on the occasion of the tenth anniversary of expropriation. Perhaps the most important news imparted by the Pemex chief was that a new well, Morallillo No. 6 in the Tepelzintla municipality, brought in at the beginning of March, had been producing for two weeks under controlled flow at the rate of 1,500 barrels daily. This is held to indicate the existence of an important field east of the Golden Lane (Faja de Oro). Good showings in Agua Dulce Poniente No. 1 suggested the possibility of another large southern field. Less conclusive but encouraging showings were encountered in test wells under the drill in the Soledad field east of the Alamos in the extreme south of Faja de Oro.

Senator Bermudez reported that crude oil output in 1947 was 57,000,000 barrels compared with 49,239,800 in 1946 and 46,803,000 in 1937, the previous high records in recent years. Production in 1948 is expected to exceed 60,000,000 barrels. Exports last year amounted to 13,990,000 barrels or 1,166,000 per month, a gain of more than 40 percent over 1946. Income from domestic and export sales in 1947 was 759,318,000 pesos ($152,000,000).

Relating to current activities the report stated that 39 geophysical crews, of which 32 are now active, are to be employed this year in surveys in different areas, including California Baja, Nuevo Leon, Chihuahua, Tamaulipas, Vera Cruz, Chiapas, Quintana Roo on the borders of Oaxaca, Puebla and Guerrero, and in parts of Nayarit and Sinaloa. Wildcat drilling in 1948 has been limited to 58 wells because of difficulties in obtaining equipment and material. If these difficulties are surmounted, more such wells will be drilled. Private contractors have been engaged to drill wells "in view of the imperative necessity of increasing reserves." These contractors are now operating in northern Chihuahua, northern Tamaulipas and the Tampico Basin. At present 27 exploration wells are drilling. Pemex now has 33 drilling rigs, most of them capable of reaching 10,000 feet or more. Delivery is expected soon of four rigs for cleaning and repairing wells, and ten more are to be bought. New drilling contracts are to be let.

Exemplifying the steadfast attitude of Mexico regarding foreign ownership of oil properties, Pemex has just announced its purchase of six small properties, subsidiaries or affiliates of companies previously expropriated. At the time of the sale, which is reported to have been made at prices considerably below assessed value, injunction proceedings against expropriation were pending. Senator Bermudez, in commenting upon the transaction, said that oil men desiring to invest in Mexico must have a "1948" mentality, explaining the phrase to mean that they must have a full understanding that Mexican oil is fully nationalized.



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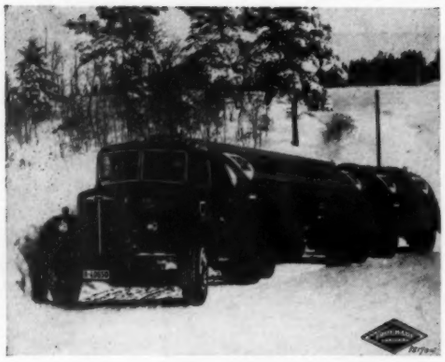


Road Transport Unit for Norway

Norwegian government officials, oil company representatives and transportation men gathered at Oslo early in the year to witness the demonstration trip of a motor transpor unit which, in size and several of its features, was new to most of the observers. The unit, which had been built, shipped and delivered on emergency order within 90 days through the cooperation of American manufacturers, was designed to aid in relieving the shortage of road transport facilities for the delivery of fuel oil in Norway. It was constructed for British Petroleum Co. marketing subsidiary of Anglo-Iranian Oil Co., Ltd., and has a capacity of 7,750 gallons. It consists of a Mack tractor equipped with a Cummins NHB diesel engine, a 5250-gallon Fruehauf semi-trailer and a 2500-gallon, four-wheel trailer.

The engine develops 200 HP at 2000 rpm. Transmission has ten speeds forward and two reverse. The rear axle is a bogie with tandem axles to meet local axle-load regulation. The entire vehicle has 26 wheels plus two spares, wtih tire equipment 10:00 x 22 inches. It carries B-W air brakes. Electrically operated sanders for rear wheels and a 125-gallon safety tank were supplied by Fruehauf. The discharge pump with a capacity of 100 gallons of heavy fuel oil was provided by Geo. D. Roper Corp.

The semi-trailer is of drop-frame style, built of special steel. The under construction is of Fruehauf gravity tandem suspension with torsion bar springs. Equipment includes emergency valves, remote control for tank discharge and heating coils along the bottom of the tank.

Heads Ontario Engineers

George L. Macpherson, manager of engineering and development division of the manufacturing department of Imperial Oil, Ltd., has been elected president of the Association of Professional Engineers of the Province of Ontario. Mr. Macpherson has been a member of the association for ten years and a member of the council since 1944. He was elected vice president last year. George Macpherson joined Imperial in 1922. In 1935 he became assistant chief engineer and chief engineer in 1943. His title was changed last May when the engineering and development division was formed.

Australian Plant Begins Operations

Bitumen and Oil Refineries (Australia) Ltd. is completing construction of its new asphalt refinery at Bannerong, near Sydney. First runs are expected to be made in June. An initial cargo of crude oil was shipped from Bahrein Island in April.

The plant has a capacity of about 50,000 tons of asphalt annually as well as gasoline and other petroleum products. Equipment includes primary distillation and vacuum reduction stills and air blowing equipment. Both paving and roofing asphalts will be manufactured.

California Texas Oil Co. owns forty percent of the stock in the new company. The remainder is widely held by Australians. Issued capital is 1,250,000 Australian pounds. Alden J. Herron, a veteran of 23 years with Caltex and its affiliates, will manage the new refinery.

Dr. Lees Made Fellow of Royal Society

The highest scientific honor in the United Kingdom was awarded to Dr. George M. Lees when the Royal Society conferred its fellowship on him recently. The Royal Society is the oldest and the leading scientific society in the British Isles, having been founded by Charles II, and its fellowship is the most highly prized of all degrees. It is rare for this degree to be conferred for research carried out in the industrial world as apart from the purely academic field, but Dr. Lees' outstanding geological work in the Near and Far East, as well as his major share in the discovery of oil in England, was held to justify the award.

Dr. Lees was educated at St. Andrews College, Dublin. He served with distinction in different branches of the British armed forces during the first world war for which he was awarded the MC and DFC. Later he served for a time as political officer in South Kurdistan. He took up geology as a hobby and then studied it at the Royal School of Mines and later in Vienna University where he gained his PhD.

He joined the Anglo-Iranian Oil Co. as geologist in 1921 and was made chief geologist in 1930. In 1943 he was awarded the Bigsby Medal of the Geological Society. This is an international award confined to geologists under 45 years of age who are active in their profession.

Manchester Oil Refinery Ltd.

Shareholders of Manchester Oil Refinery, Ltd., have approved a resolution authorizing reorganization of the company. The scheme of reorganization involves the formation of a new holding company, Refinery (Holdings) Ltd., which will acquire the shares of Manchester Oil Refinery Ltd. in exchange for its own shares. Refinery (Holdings) Ltd. will have an authorized and issued share capital of £550,000, consisting of 3,000,000 five and a half percent redeemable cumulative preference shares of £1 each, and 1,000,000 ordinary shares of five shillings each. The new company will create £600,000 of debenture stock in order to finance future operations, but no decision has been reached as to the time of issue of this stock or the amount to be issued.

Tours Latin America

C. R. Nash, vice president of the Aluminum Import Corp., New York City, is currently on a tour of all the countries of Central and South America and West Indian points, conferring with the company's agents and large users of aluminum. Aluminum Import Corp. is a distributor in the western hemisphere for all of the products of the Aluminum Company of Canada, Ltd., and other manufacturing units in the Aluminum Limited group of companies.

Peru To Set Up Government Company

Press dispatches report that the Peruvian government has authorized the establishment of "Empresa Petrolera Fiscal" to engage in all branches of oil operation. Application for the organization of such a company has been pending for a year or more. As projected it will have a capital of $30,769,230. The controlling interest is expected to remain with the government, but Peruvian private capital will be allowed to participate.

Heads Aluminum Sales

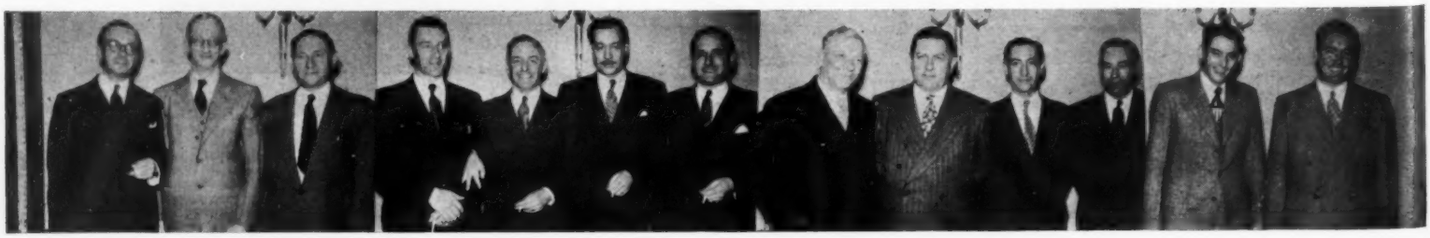
Leo Reierstad, formerly sales manager of the Chinese Aluminum Rolling Mills, Shanghai, associated with Aluminum Ltd., has joined the staff of the Aluminum Import Corp. in charge of its New York sales office. Aluminum Import Corp. is distributor in the western hemisphere for all the products of the Aluminum Co. of Canada, Ltd., and other manufacturing units in the Aluminum Ltd. group of companies.

MISS D. A. ROSS of Bahrein Petroleum Company, Ltd., has been awarded the Royal Red Cross of Britain, which is normally presented by the King in person. Due to Miss Ross' location in the Persian Gulf, she recently received a letter from His Majesty King George with the R.R.C. medal. The award was for her service with the British Military Hospital in Suez prior to her becoming matron of one of the two company hospitals on the Island of Bahrein.

Visits Latin America

Ed T. Landgraff, manager of the New York office of Chiksan Export Co., will leave shortly on a four-months' trip through South America, according to L. J. Laird, vice president and sales manager, Chiksan Co., Brea, Calif. Mr. Landgraff will cover all the important oil-producing centers on his itinerary to establish resident representatives in the various countries for Chiksan swivel joints, Well Equipment Manufacturing Corp. products, and Okadee valves, which are sold exclusively by Chiksan Export Co.

Thirteen foreign oil guests attended the April meeting of the New York Chapter of Nomads. As pictured above they are: (from left to right) D. G. Hitt, Anglo Iranian Oil Co., London; W. G. Nicholls, Kuwait Oil Co.; F. G. Cance, S.N. M.A.R.E.P., Paris, France; M. J. Galpin, IDECO-Clark, London; E. F. Fabres, Corporacion de Fomento (Chilean Govt.); M. Binet, S.N. M.A.R.E.P., Paris, France; J. R. Simpson, Imperial Oil Co., Ltd.; C. A. Rodstrom, Arabian American Oil Company; H A. Gonzalez, Argentine Government Oilfields (Y.P.F.); J. A. C. Armstrong, Imperial Oil Ltd.; L. Walker, Union Tractor & Equipment Company, Canada; S. P. King, Creole Petroleum Corp. (Venezuela)



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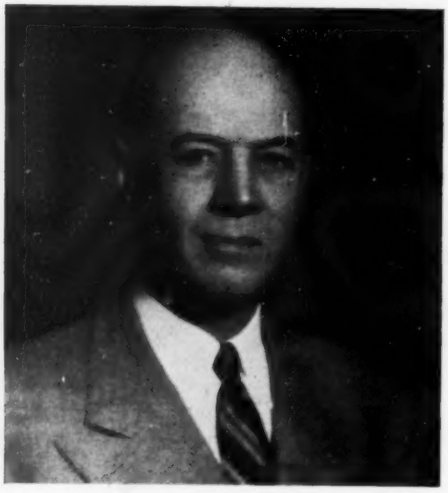
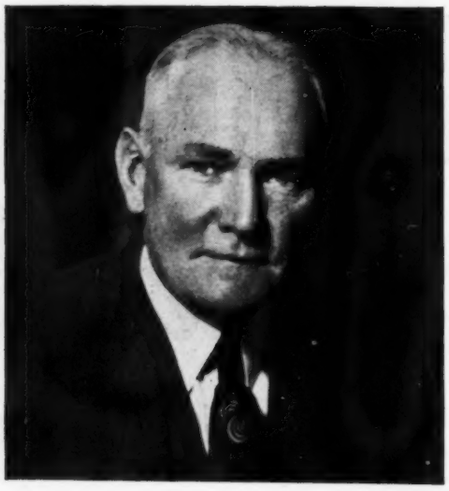
OIL COMPANY STAFF CHANGES



Harold F. Sheets



George V. Holton

HAROLD F. SHEETS has retired as chairman of the board of Socony-Vacuum Oil Co., Inc., after 41 years with the company. George V. Holton has been elected to succeed him.

Mr. Sheets started as assistant to the managing director of Vacuum Oil Company's subsidiary in Germany. Later he became president of Vacuum's affiliated companies in France, Spain, Belgium and Italy and made his headquarters in Paris. Mr. Sheets returned to the New York office in 1924 and was elected a director in 1930 and chairman in 1944. He will make his home in Santa Barbara, California.

Mr. Holton has been a vice president and the general counsel for Socony-Vacuum. He left his law practice in Rochester, N. Y., to become assistant counsel for the Vacuum Oil Co. in 1923. He became a director of that company in 1931 and the following year, upon the merger of Vacuum and Standard Oil Co. of New York, became the general counsel and a director of Socony-Vacuum. He was elected a vice president in 1938.

PAUL L. LYONS has been made manager of the land department of Warren Oil Corp., at Houston. He has been connected with the Warren organization for three years. Mr. Lyons entered the oil industry in 1921 as a scout for Sinclair Oil & Gas Co. and was chief scout for Stanolind Oil & Gas Co. when he resigned to join Warren in 1945.

AUSTIN T. FOSTER has been appointed general counsel and Carl E. Kieser as associate general counsel of Socony-Vacuum Oil Co., Inc. Mr. Foster succeeds George V. Holton who was elected chairman. Mr. Foster and Mr. Kieser joined the law staff of the company in 1928 and 1929, respectively, after each had spent several years in private practice.

W. C. MacMILLAN has been elected president of Texon Oil & Land Co., Group No. 1 Oil Corp. and Group No. 2 Oil Corp., non-consolidated affiliates of Continental Oil Co. Mr. MacMillan is also vice president in charge or Continental's production and drilling operations. E. J. Sheldon Ponca City, was elected a director of Texon.

MARTIN M. SHEETS has resigned from Stanolind to become chief geologist for Production Maintenance Co., Houston, Texas. After spending over two years in the potroleum engineering department of Humble, Mr. Sheets joined the Stanolind as a scout in 1935. During his 13 years at Stanolind he rose through various geological assignments to become district geologist in 1944. He became division geophysical supervisor in 1946 and was serving in this capacity when he resigned.

COL. GEORGE A. BURRELL, president, Atlantic States Gas Company, Inc., New York, was given the Hanlon award at the recent annual convention of the National Gasoline Association of America at Fort Worth. He is the twelfth recipient of the award which is conferred each year by the NGAA for outstanding service to the natural gasoline and cycling industries.

Following his graduation from Ohio State University in 1904, Col. Burrell went to the U. S. Bureau of Mines to study mine gases. This led to similar studies of natural gases, and in 1911 he took part in experiments in West Virginia which led to the first separation and recovery of liquefied petroleum gases. He was one of the first men to recognize the deviation from accepted gas laws of natural gases under pressure and published a report on the subject in 1916. He received the Distinguished Service Medal in World War I for his work on gasses. He is the author of numerous bulletins, engineering reports and technical articles and has written three books.

Col. George A. Burrell

CLAUDE E. LEACH has been named assistant to Fred A. Menken, manager of the geological department of Tide Water Associated Oil Company's western division at Los Angeles. A. S. Holston has been appointed assistant senior geologist. William D. Cortwright was appointed district geologist of the San Joaquin division, and Harry M. Whaley, geologist at Santa Maria, California.

J. M. P. McCRAVEN has been appointed manager of the railway traffic and sales department of The Texas Co. to succeed the late J. L. Lavallee. Mr. McCraven joined The Texas Co. at Houston in 1916 as a clerk and advanced through various positions to assistant manager of the department, which post he held at the time of his appointment.

THOMAS L. CUBBAGE has joined Stanolind Oil and Gas Company as operating superintendent in the manufacturing department in charge of operations of Stanolind's gasoline and cycling plants and its refinery at Superior, La. He was formerly plant superintendent of the government-owned, Phillips Petroleum Company-operated Plains Butadiene plant at Borger, Texas.

E. J. YOCUM has been appointed plant superintendent of Stanolind Oil and Gas Company's cycling plant at South Jennings, Louisiana. Mr. Yocum had previously been plant foreman at this plant.

EARLE W. WEBB has retired as chairman of Ethyl Corp. after nearly 23 years with the company. While relinquishing all administrative duties, he will continue as a director and will maintain space in the New York offices. Mr. Webb has been associated with Ethyl for all but eight months of its entire existence. Joining it as president in April, 1925, he served in that office until August, 1947, when Edward L. Shea was named to succeed him in the presidency and Mr. Webb was elected chairman.

Mr. Webb joined General Motors as general attorney in 1922. At that time Thomas Midgley, Jr., and his associates at the General Motors Research Laboratories had discovered tetraethyl lead, and Earle Webb was asked to draw up the incorporation papers for the General Motors Chemical Co., which was to handle the marketing of "Ethyl" fluid. In 1924 consulting chemists of the Standard Oil Co. (N. J.) evolved a more efficient and less expensive method of making tetraethyl lead, and Ethyl (Gasoline) Corp. came into being in August, 1924. Charles F. Kettering served as its president for a time until the pressure of his research duties compelled him to give all of his time to the research laboratory, and Mr. Webb succeeded him.

Earle W. Webb

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★ Seismograph Service Corporation of Venezuela
★ Seismograph Service Corporation of Peru
★ American Exploration Company (U. S. A.) Marine
Seismograph Service Corporation
TULSA, OKLAHOMA, U. S. A.

Tighe Returns To Motor Age

Frank P. Tighe, director of public relations and advertising manager for Houdry Process Corp., has resigned to become editor of Motor Age. In his new position he will be returning to a former connection with the Chilton Co. which dates back to 1925. As managing editor he brought out the first edition of the new Motor Age in 1935. During the war he was head of the business magazine section of the office of censorship.

Foster Wheeler Officials Promoted

Martin Frisch, vice president in charge of engineering of Foster Wheeler Corp., has been elected a director. Mr. Frisch joined the company in 1929 and was elected a vice president last year. Lee Allen Swem, a director and assistant to the president for the past three years, was lected a vice president. Mr. Swem became associated with the company in 1936 as patent counsel.

Elected Franks Vice President

R. M. White has been elected vice president and sales director of Franks Manufacturing Corp. He has been Franks district manager at Fort Worth.

E. G. YOUNGBERG, recently general manager of Pana Refining Company, Pana, Illinois, joined Allied Oil Company, Inc., following sale of the Pana plant. He had been general manager for Pana since 1941 and previously was sales manager. In his new position Mr. Youngberg will devote most of his time to the procurement of fuel oil and other petroleum products for Allied. He will manage a new office in the Chicago area.

W. W. Davison

W. W. DAVISON has been appointed a vice president of Standard Oil Company of California. He has been general manager of Standard's El Segundo refinery. Mr. Davison joined Standard as a junior engineer in 1921 and the following year was made assistant chief engineer. In 1928 he was assigned to the manufacturing department, and he was made superintendent at the Standard Oil Company of British Columbia plant at Vancouver, B.C., in 1936. Four years later he became assistant superintendent at El Segundo and in 1944 was made manager.

C. E. Finney, Jr.

C. E. FINNEY, JR., a vice president of Standard of California, has been elected president of the Salt Lake Refining Co. and the Salt Lake Pipe Line Co. In his new position he will direct the construction and operation of both projects. Each will cost approximately $5,000,000, and they are scheduled to be completed and in operation by Nov. 1, 1948.

Mr. Finney joined Standard in 1919. He became assistant superintendent of the Richmond refinery in 1928 and later manager of pressure distillation. In 1931 he was named manager of the subsidiary Pasotex refinery at El Paso, Texas, and the following year returned to Richmond as manager of the refinery. He was made assistant to the general manager of the manufacturing department in the home office in 1937 and general manager in 1943. He became a vice president in 1946.

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M. O. Johnston

Celebrates Twentieth Anniversary of Formation Testing

M. O. Johnston, pioneer oil man, inventor and manufacturer, is celebrating the twentieth anniversary of formation testing in which he is generally recognized as a pioneer. A family project, the Johnston Formation Tester was designed and built by the seven Johnston boys in the middle twenties while contracting and drilling wells in Arkansas, and the first commercial run was made in May, 1928. While J. L. Johnston introduced the tool in Texas, M. O. Johnston came to California and made the first formation test in the state's history for the Ohio Oil Company in July, 1930.

A casing packer was soon developel, and in 1931 the California State Mining Bureau, Division of Oil and Gas, approved the use of formation testers for water shut-off tests for well completions. In 1933 the new testing tool was used in a well at Lost Hills field, in which numerous oil companies were interested, and after that its use quickly spread throughout the world. M. O. Johnston's development of numerous formation testing accessories has added greatly to the testing tool's effectiveness.

M. O. Johnston's father, R. C. Johnston, an old-time Texas water well driller, helped drill the famous Crazy Well at Mineral Wells, Texas, and moved to Beaumont, Texas, when the Spindle Top field was discovered. He raised seven sons, all of whom spent their entire lives in the industry.

The imprint of M. O. Johnston's development efforts has also been felt on gun perforators. When he came to California in 1930, he also brought with him the patented Rembert gun perforator, a mechanical four-shot gun which he had run in Arkansas. Before relinquishing his interest in this tool, he developed an electrical firing device. More recently he took a partially developed gun perforator and perfected the hydrostatically-fired tool now known as the Johnston Shoot-N-Test gun perforator. This companion tool for the Johnston Formation Tester is an all-purpose gun perforator which can be used either for perforating alone or when attached to the Johnston formation tester and pressure recorder as a unit in combined perforation and formation testing operations. Another piece of equipment in which "M. O." has played an important development role is a casing packer for testing purposes.

M. O. Johnston is president of the M. O. Johnston Oil Field Service Company, Los Angeles, and the M. O. Johnston Oil Field Service Corporation, Los Angeles, and is controlling head of the Johnston Oil Field Service Corporation, Houston, Texas. The Johnston Company handles export sales and the two Johnston Corporations furnish formation testing and gun perforating service throughout the United States. Gulf Coast and Mid-Continent operations are handled from the Houston headquarters. Rocky Mountain Territory, California and New Mexico are serviced from Los Angeles. The Houston office maintains its own airplane to expedite sales and service facilities.

Celebrates Pipeline Anniversary

Shell Oil Company celebrated the tenth anniversary of the East Products Pipe Line, the first precision-dispatched pipeline for oil products in the United States, at a dinner at Toledo, Ohio, April 20. Originating at Shell's Wood River, Ill., refinery, the eight-inch-diameter line runs 350 miles to Lima, Ohio, and there is a six-inch-diameter extension reaching 100 miles further to Springfield and Columbus. The line began operations in April, 1938, with an initial shipment of 2,436,000 gallons of gasoline and since then has carried more than three and a quarter billion gallons of automotive and aviation gasoline, kerosene and distillates. The line is a pioneer in multi-product operations. It carries as many as 12 different products at once. It was the first in the country with fully automatic devices for starting and stopping pumps, regulating pressures and maintaining constant rate of flow.

The real key to the control of product movement, according to S. S. Smith, line manager, is accurate measurement of products entering and leaving the line. The arrival time of a product at any given point can be predicted within a range of only five minutes. Take-off points along the pipeline are equipped with specially designed metering devices enabling them to remove all or part of a tender from the line with great precision and virtually no mixing of products. The line was originally designed for a capacity of 16,000 barrels a day but was carrying 25,000 barrels within the first year of operation. An improvement program now under way will raise line pressure from 1,000 to 1,200 pounds and so increase capacity by another 4,000 barrels a day.

The Johnston brothers, left to right: E. L., M. O., R. C., J L., and E. C. (Blaine and J. T. have died.)
All seven of the boys were instrumental in developing the Johnston formation tester.

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Creole's Capital Expenditures

Creole Petroleum Corporation established a new record for reinvestment of capital in Venezuela in 1947 when it spent $122,463,279 for property, plant and equipment, according to the company's annual report. This was an increase of nearly 76 percent over 1946 reinvestment. Investment of earnings in 1948 will be still greater, the report said, after pointing out that increasing demand for petroleum products requires new plant facilities that are becoming increasingly costly to build.

One-third of the reinvestment made in 1947 was financed from the company's savings. This amounted to $41,662,914. A total of $57,051,272 was obtained from earnings after payment of dividends, and $23,749,093 was obtained through depreciation. The net result was that even though earnings reached a new high level of $130,750,261, the company's working capital was cut nearly in half, from $55,563,445 to $29,956,350.

The company's liability for payment of pensions and service indemnities reached a new high of $19,355,024 at the end of 1947, the report said, and this sum is held in reserve. Almost one-half of this amount is set aside for pension pay to employees who retire under the provisions of the company's pension plan adopted July 1, 1947. Direct wages paid to employees in 1947 reached a new record total of $45,900,000. The amount spent on behalf of employees for benefit of their health and social welfare amounted to $33,361,000. The report especially called stockholders' attention to increasing costs. As an example the report mentioned the Amuay Bay refinery now under construction. Its cost is now estimated at $120,000,000. The same installation could have been constructed for one-half this amount in 1940.

Rear Admiral Thomas E. Boyce

REAR ADMIRAL THOMAS E. BOYCE, USN, (ret.) has been appointed marine superintendent for Stanolind Oil & Gas Co. and will have his headquarters in the Houston division office where he will work under the direction of R. G. Bechtel, division production superintendent. Stanolind soon will begin drilling at four offshore Gulf Coast locations. One feature of Stanolind's marine program will be the use of a permanent platform for the entire drilling operation and crew housing at the first location, rather than the use of a floating barge tied to the drilling platform. With such a platform it is expected that the rig can operate even in bad weather. The platform will be supported by 36 thirty-inch steel piles and is designed to withstand 125 miles-per-hour hurricanes and waves 25 feet high. Brown and Root, marine contractors, are building the platform, and erection will begin within the next several months.

Quantity-Price Slide Rule

A slide rule especially designed for conversion of oil volumes, gravities and prices in use by various nations has been designed by Paolo Sbernadori of Rome, Italy. Given an initial quantity of price, related to a certain unit of measure (in weight or volume), by simply setting the instrument for the specific gravity or API gravity of the oil, it is immediately possible to read simultaneously on the opposite scales all the corresponding quantities or prices related to the other units of weight or volume, such as long tons, metric tons, short tons, quintals, kilograms, pounds, cubic meters, barrels, hectolitres, Imp gallons, U. S. gallons, cubic feet, litres and quarts. It is not necessary to know any conversion factor nor to consult any table or diagram, as hitherto had to be done even when using ordinary slide rules.

In another portion of the instrument, in like manner, the equivalent value of English and U. S. money may be immediately found opposite each other, after simply setting the scales for the rate of exchange. It is possible to extend such computation to any other metric currency. The one-foot rule is priced at $20 (U. S.) delivered.

Research Expenditures

Standard Oil Co. (N. J.) spent $18 million on research in 1947 according to its annual report. This is an increase of 18 percent over 1946. Much of the company's current work deals with production of synthetic oils from gas and coal. Laboratories at Linden, N. J., and Baton Rouge have been enlarged, and Carter Oil Company's production research facilities at Tulsa have been doubled.

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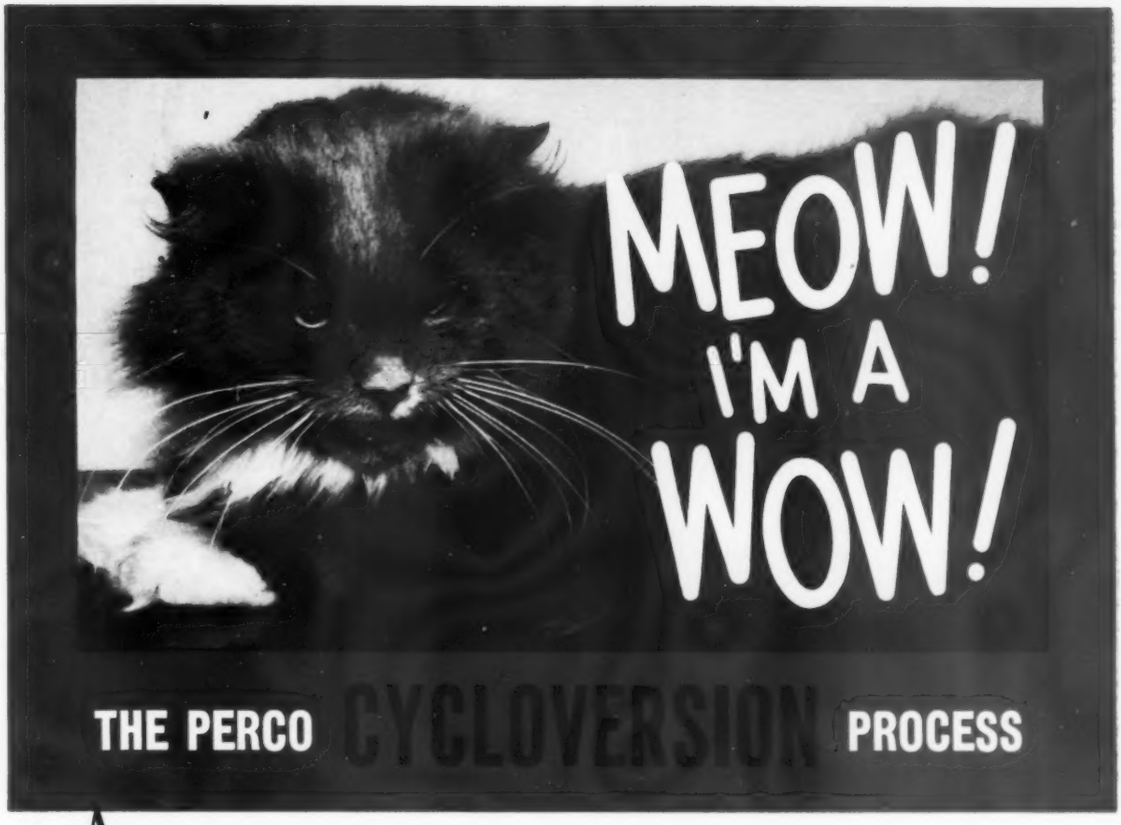

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PROFIT WITH PERCO PROCESSES

* For recent developments in the Perco Cycloversion Process, see the December 13th, 1947, issue of *Oil and Gas Journal*

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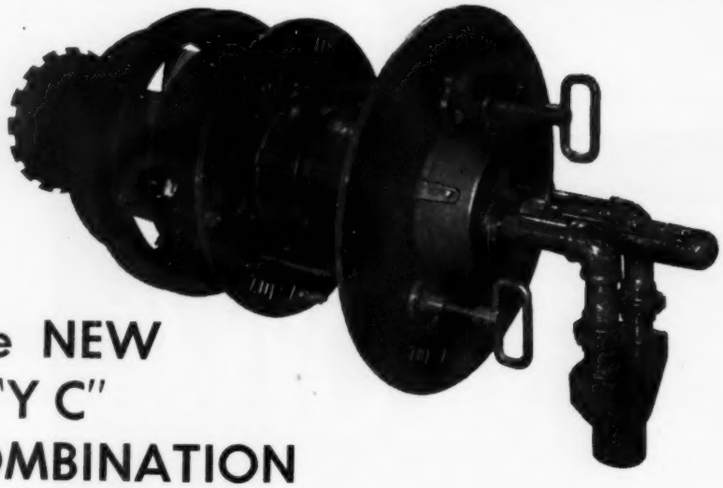

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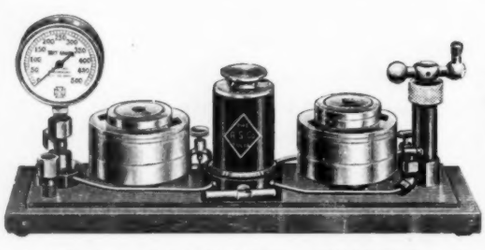

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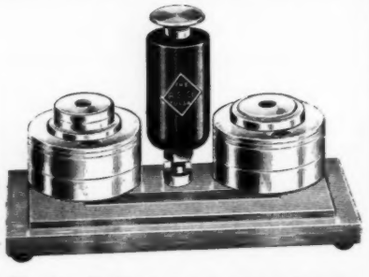

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F. L. Prosser Herschel Lewis

D + B Personnel Changes

F. L. Prosser has been made manager of the D+B mid-continent division of Emsco Derrick and Equipment Co. Herschel Lewis succeeds him as mid-continent sales manager, and Jo Earl Morris becomes assistant sales manager. Mr. Prosser joined the company in 1936, established the first Continental D+B field store in 1940, was made manager of stores in 1942 and sales manager in 1944.

HARRY W. HOWZE, an executive in the aviation department of Esso Export Corp., New York, has been made an Honorary Commander of the Military Division of the order of the British Empire. Lord Inverchapel, the Ambassador, made the award at the British Embassy at Washington. Colonel Howze was cited because of his work during the war with the U. S. Army-Navy Petroleum Board and Aviation Petroleum Products Allocation Committee in Washington.

DAVID GORDON, consulting engineer, New York City, has been appointed by the process industries division of the American Society of Mechanical Engineers to act as its liaison officer with the American Institute of Chemical Enigneers and the American Chemical Society.

ROBERT A. FEAGAN has been made process engineering supervisor in the manufacturing department of Stanolind Oil and Gas Corp., Tulsa. He was formerly a mechanical engineering group leader.

D. N. Pollock

D. N. Pollock, 52, sales manager heavy vehicle department of Scammell Lorris, Ltd., Watford, Herts, England, died on April 9 after an extended illness. Mr. Pollock had been with Scammells for some twenty years. He underwent an operation in January last which failed to restore him to health.

Venezuelan Production

Production of crude oil in Venezuela during the month of February amounted to 37,633,719 barrels, an average of 1,297,714 barrels daily. As compared with January, this daily average is higher by 16,203 barrels. Exports for the month were 32,739,765 barrels. Production by companies is shown in the following table:

Company	*West*	*East*	*Total*
Creole	13,729,409	4,438,695	18,168,104
Mene Grande	1,800,177	4,478,152	6,278,329
Shell	11,426,840	—	11,426,840
Consolidada	—	560,842	560,842
Socony	—	872,053	872,053
Texas	—	221,130	221,130
S.A.P. Las Mercedes	—	3,500	3,500
B. C. O.	32,342	—	32,342
Phillips	—	59,868	59,868
Orinoco	9,375	—	9,375
Atlantic	—	1,336	1,336
Total Barrels	26,998,143	10,635,576	37,633,719

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Don M. Mattocks

DON M. MATTOCKS has been elected secretary of Warren Petroleum Corp. to succeed John T. Oxley, resigned. Mr. Mattocks joined the company as an attorney in 1940. Since the acquisition by Warren of the Hanlon properties in 1946, he has been first assistant to James E. Allison, vice president and general counsel.

Petrochemicals Progress

A report on the progress being made in design and construction of its chemical plant at Partington, England, was made at the recent annual meeting of Petrochemicals Ltd., and Petrocarbon Ltd. Orders have been placed for equipment costing £1,500,000, and a great deal of site preparation work has been done.

Changes made in the plant during development of the design have increased the effective capacity to 65-75,000 tons per year from the original 50,000-ton capacity. Date for completion of the plant has not been announced because of delays in obtaining some equipment, but present plans are to have some units in operation late in 1948 and the entire project functioning by about the middle of 1949.

Research Appointments

H. S. Peiser, x-ray crystallographer of Birkbeck College, and Dr. W. F. Ford, a refractories expert of Sheffield University, have recently joined the research staff of Hadfields, Ltd., Sheffield, England. During the war Mr. Peiser was engaged in work connected with atomic energy and the development of synthetic high polymers. Dr. Ford is the author of numerous scientific papers dealing with refractory materials.

Co-op Buys Pana Plant

Illinois Farm Supply Co., oil cooperative affiliate of the Illinois Agricultural Association, has purchased the 4,000-barrel plant of Pana Refining Co., Pana, Ill. E. G. Youngberg will remain as general manager for the new owners.

New Shell Chemical Plant

Construction is under way on a new Shell Chemical Corporation plant at Martinez, California, to manufacture petroleum additives. Ralph M. Parsons Co. is the contractor for engineering and construction. It is scheduled for completion late this year.

JERRY LUBOVISKI, former city editor of the Los Angeles Daily News and the San Diego Daily Journal, has been appointed public relations representative of the Western Oil and Gas Association, Los Angeles. The Association represents approximately 90 percent of the oil industry on the West Coast.

Byron Jackson Appointment

Robert V. Wildman has been assigned to Houston, Texas, offices of Byron Jackson Co., Oil Tool Division. He will work on export sales as well as in East Texas and Gulf Coast territories.

W. G. Skelly

President

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Oil Production from Southwestern Iron Fields

(Continued from page 66)

The efficiency of dissolved gas drive in sand fields never exceeds about 25 per cent recovery of oil in place, the more usual recovery being 15 to 20 per cent. In the sand fields, however, the rate of reduction of pressure has invariably been far higher than the rates in the fields of Southwestern Iran and it may be that in the latter the recovery may exceed 25 per cent.

The conditions limiting recovery is that when gas bubbles in the pores of the limestone link up and form a continuous gaseous path along which all gas subsequently evolved from solution passes to an open fissure without pushing any oil ahead of it.

It was mentioned previously that the saturation pressure inside a mass of limestone (and therefore remote from an open fissure) might be appreciably higher than in the neighboring fissures. If this should be the case, reduction in pressure would cause bubbles to be formed first of all at the point of highest saturation pressure inside the limestone and thus give a higher efficiency of recovery.

In order to achieve maximum recovery a greater reduction of pressure is required in the higher pressure reservoirs as shown in Fig. 8.

In conclusion, it must be emphasized that no two oilfields are ever exactly alike. In these limestone fields the amount and variation of fissuring, the arrangement and occurrence of the various types of limestone, the edge-water conditions, and the saturation pressures of the crude, all affect the production mechanism and recovery of oil. An adequate number of observation wells by which the gas, oil, and water pressures and levels can be recorded is essential for the efficient control of the field, and to enable unforeseen occurrences to be quickly diagnosed and dealt with.

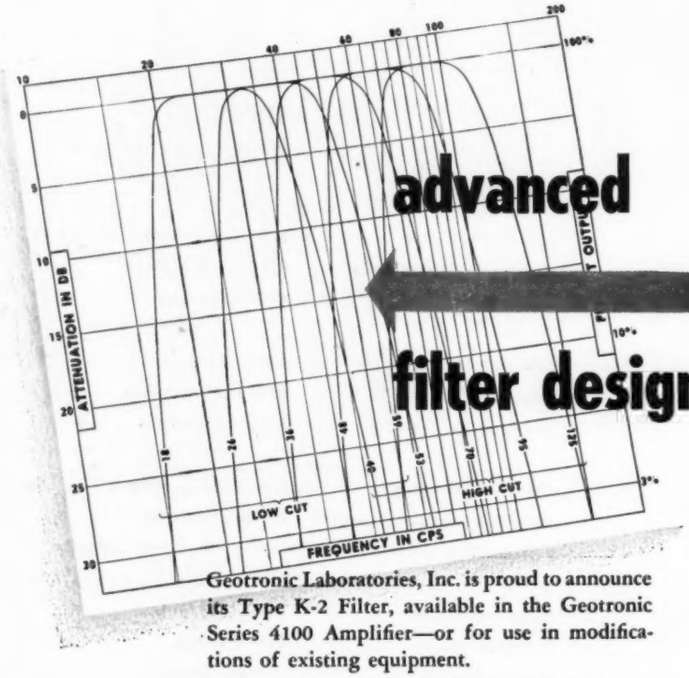
Romano Americano Seized

Reports reaching Standard Oil Co. (N. J.) are that the Romanian Ministry of Mines and Petroleum has removed the management of its Romanian subsidiary, Romano Americano, and substituted state officials. Similar action was taken some months ago in the case of Shell and Phoenix Oil and Transport. No information has been received regarding properties of other foreign companies.

It is assumed by the New Jersey Standard that the Romanian action is, in effect, expropriation of its properties, but no information has been received as to what compensation will be paid for them. Properties involved include oil production currently averaging about 12,000 barrels daily, a system of crude pipelines, a 15,000-barrel refinery and a fleet of tank cars for the distribution of refined products. The oil refinery had a prewar capacity of some 25,000 barrels but was badly damaged by bombing and has been restored to only about 60 percent of its former capacity.

As a matter of fact Standard of New Jersey has had virtually no control over the operations of Romano Americano since the outbreak of the war nearly ten years ago. When nominal management functions were resumed at the close of the war, a great many regulations were imposed by the government. Under the reparations agreement with the U.S.S.R., virtually all oil and products above domestic needs was sent to Russia. Prices for crude and products were fixed at a level which made it very difficult for all oil companies to pay wages to employees and attempt rehabilitation of properties. Little, if any, money was available for the purchase of equipment, and, for that matter, there wasn't any equipment on the market to buy.

Principal effort of the New Jersey company was to try to feed and clothe its employees of many years' service. At least 5,000 C.A.R.E. parcels and 5,000 pounds of clothing and 230 tons of wheat were sent in from the U. S. last year. Under state control it is assumed that many of the employees, especially in the management group, will be displaced by state appointees. Charges quoted in press reports at the time of state seizure were that Romano Americano was paying too high salaries to its managers and directors. However since the monetary reforms of 1947 salaries for all executives and employees have been fixed by the government. On the other hand no dividends have been paid to the owners since before World War II.



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Hall of Science Portrays Industry's Progress

(Continued from page 71)

the auditoriums of Tulsa Central High School beginning May 18. Alf G. Heggem, veteran petroleum engineer and vice president of the Exposition has been appointed chairman of the Congress. Gov. Beauford H. Jester of Texas is to deliver the opening address. Ather speakers include Benjamin F. Fairless, president, United States Steel Corporation, Charles F. Kettering of General Motors Corporation, Hon. N. E. Tanner, Canadian Minister of Land and Mines and Senator Antonio Bermudez, general manager of Petroleos Mexicanos. It is intended to serve as a forum for the exchange of views and ideas on the technical and economic aspects of exploration, production, refining, transportation, conservation and marketing. It was felt that discussion rather than a series of prepared papers would lend spontaneity to its procedings. Official standing is given the Congress by participation in it on the part of government and industry representatives of many countries. Keen interest has been displayed in the Congress by these representatives since such a gathering was first projected some months ago.

Mississippi Joins Compact

Mississippi became the twentieth member of the Interstate Oil Compact Commission by action of the state legislature. A five-man state oil conservation board also was set up. Membership of the 13-year-old Compact Commission now includes states in which is produced more than 80 percent of the nation's oil and 90 percent of the natural gas.

United States Exports

As reported by the Economics and Statistics Division of the Bureau of Mines, exports of crude oil and products for the United States during 1947 amounted to 164,471,000 barrels, a daily average of 450,000 barrels. Classified by products, exports were as follows, in thousands of barrels:

Crude petroleum	46,117
Motor fuel (incl. aviation gasoline & benzene)	47,563
Kerosene	7,264
Distillate fuel oil	29,919
Residual fuel oil	10,745
Lubricating oil	14,236
Other	8,627
Total	164,471

Testing Methods

Standard Methods for Testing Petroleum and its products (Ninth Edition, 1948). Published by the Institute of Petroleum, 26 Portland Place, London W.1, England. 616 pages, 149 diagrams, price 31s. post free. (Obtainable also from The American Society for Testing Materials, 1916 Race St., Philadelphia, U. S. A., at $6.75.)

The ninth edition of "Standard Methods" contains 40 more pages of technical data than the previous edition. Two previous methods have been withdrawn, one in favor of an improved method; while 15 methods are either new or have been revised in detail more or less extensively. So that these modifications may not be overlooked by previous users of the volume, the parts of the text at which they occur have been marked with marginal lines—this in addition to their being listed in the introductory part of the book.

The Standardization Committee of the Institute of Petroleum is responsible for the methods, and the work of the committee is discussed on broad lines in the Annual Report of its chairman. The bases for his conclusions are given in greater detail in the reports of the chairmen of the 15 controlling sub-committees under which the work of 40 specialist panels is co-ordinated. These reports, given in the introductory matter, discuss not only work achieved but also work in hand or about to be undertaken.

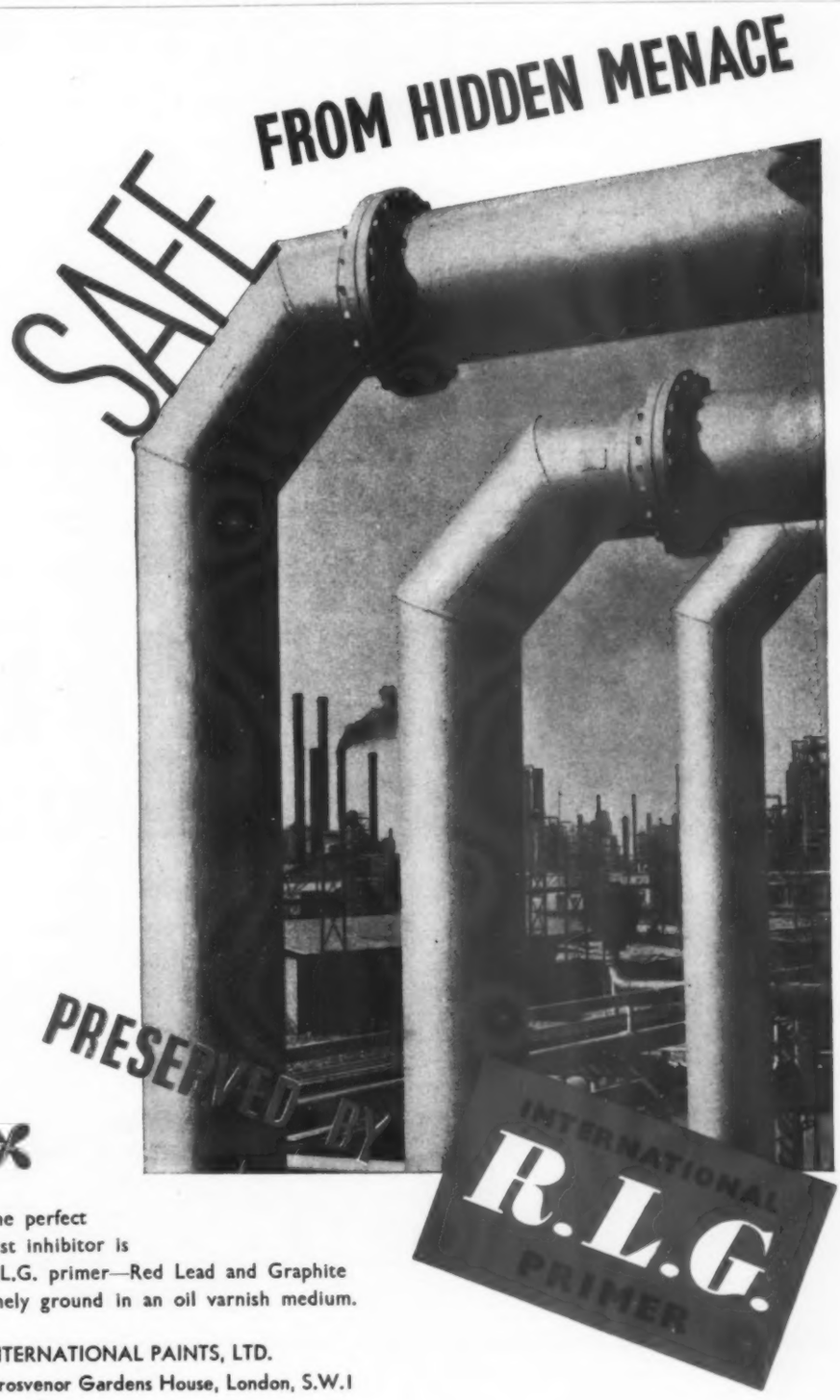
Record Cracking Still Run

Cooperative Refinery Association recently set a new record at its Coffeyville, Kan., plant when it shut down a 4,200-BD two-coil Dubbs cracking unit after 164 stream days during which 720,000 barrels of charge stock were processed. The run could have been extended, the shut-down being scheduled to suit the convenience of the maintenance crew.

This plant also operates a UOP catalytic polymerization unit. The poly plant recently changed catalyst after producing 144 gallons of 10-pound gasoline per pound of catalyst. This is more than double the usual production.

Imperial Pipe Line Co. President

W. G. Sexton, formerly chief engineer at Transit and Storage Co., has been elected president and general manager of Imperial Pipe Line Co., Ltd., with headquarters in Edmonton. Mr. Sexton joined Imperial in 1921 at Sarnia, serving in various capacities in the refinery, engineer and accounting departments. In 1936 he was transferred to the United States with Transit and Storage Co. which operate pipelines from Ohio and Michigan, supplying crude to the Sarnia refinery. During World War II he served three years in the U. S. Navy, returning to Transit and Storage in December, 1945.



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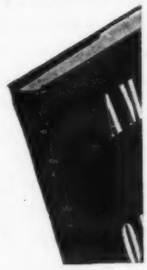

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